VL/H

SIEMENS

Level Meter D 2006

10 KHz to 17 MHz
with Frequency lock-in

Instructions for Operation

S45034-D2006-B102-51-7618

SIEMENS AKTIENGESELLSCHAFT

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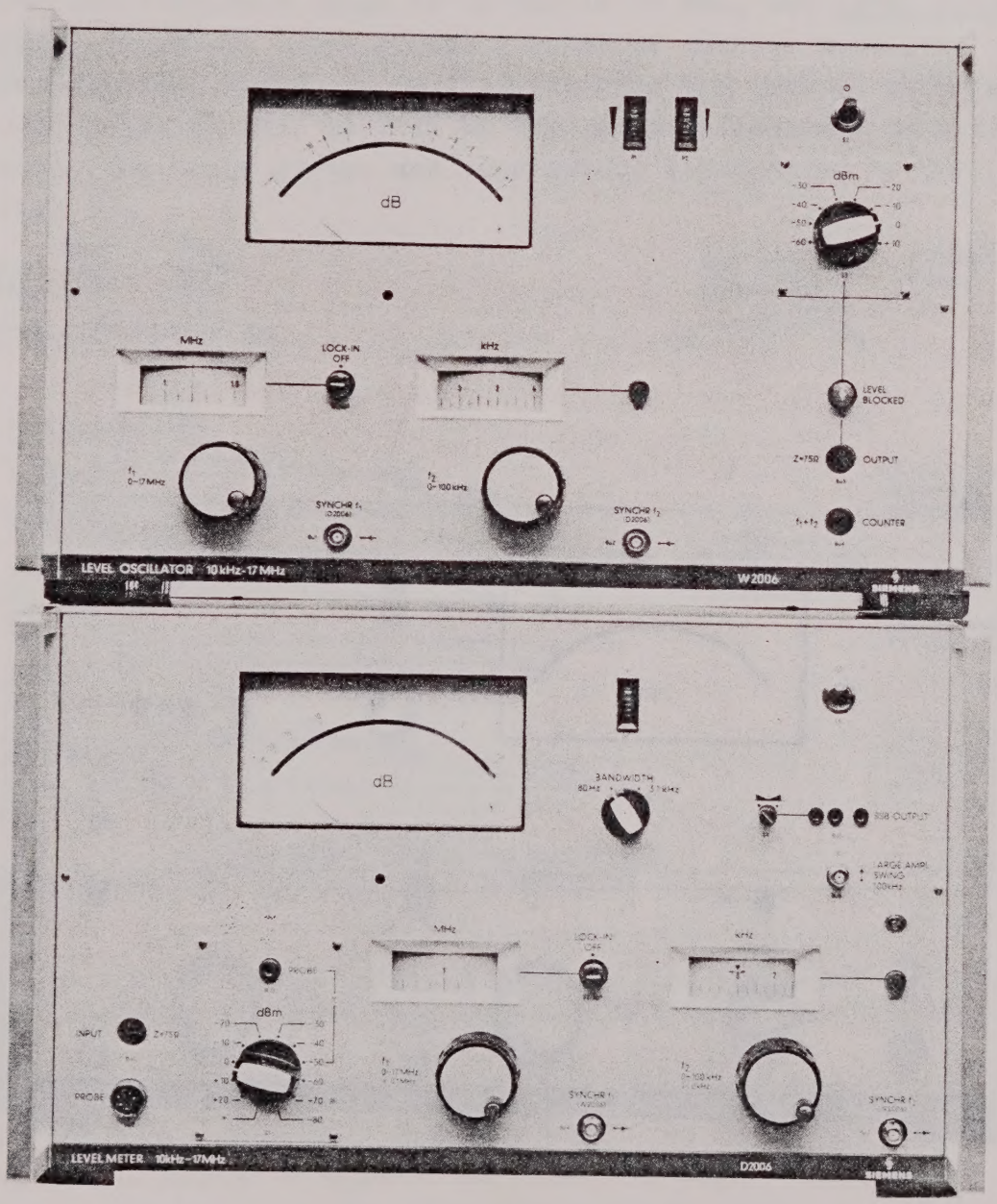
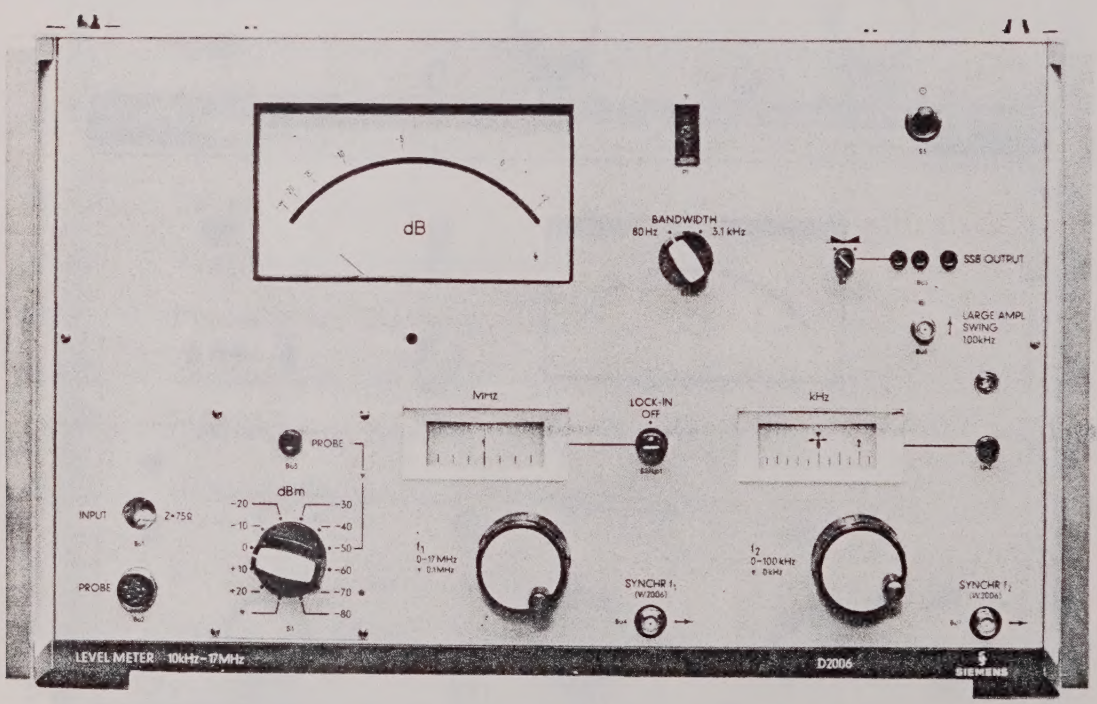


Level Measuring Setup 10 kHz to 17 MHz W 2006/D 2006



Level Meter 10 kHz to 17 MHz D 2006

1.1. Application

1.1.1. General

With its frequency range of 10 kHz to 17 MHz, the level meter D2006 covers the line-frequency bands of carrier multiplex telephone systems having up to 2700 channels for coaxial cable and radio relay routes, as well as the carrier-frequency television bands, the basic groups and supergroups recommended by the CCITT (Fig. 1).

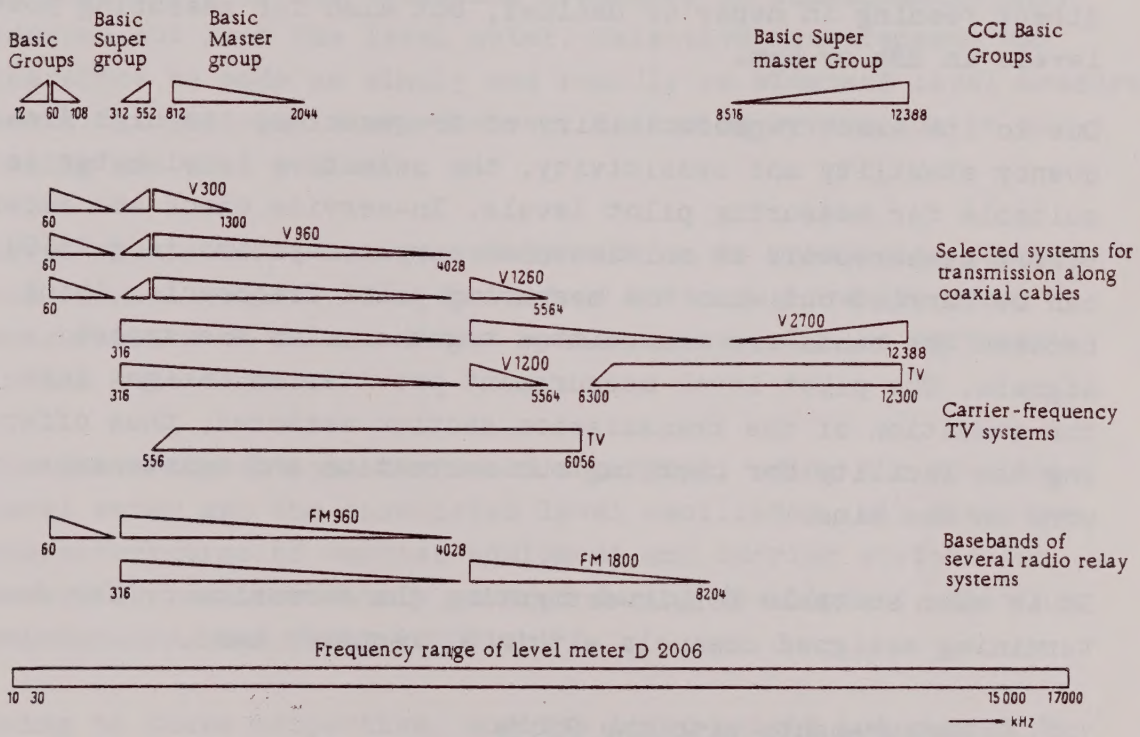


Fig. 1 Survey of the wideband transmission bands and CCI groups within the frequency range of the level meter D2006

The level meter stands out by high stability and accuracy of the automatic frequency control, which can be brought to a crystal accuracy of approx. $\pm 2 \times 10^{-5}$ by means of an on/off electrical lock-in facility. This high accuracy makes it suitable for frequency determination, for instance, and, in conjunction with a graphic recorder, for permanent supervision of pilot levels.

The wide measuring range of 130 dB permits crosstalk and distortion attenuation measurements, the high selectivity and image-frequency rejection as well as the low residual distortion of the level meter ensuring a high measuring accuracy of measuring level and frequency.

The level meter is also suitable for noise level measurements because of its well-defined bandwidth and rms response.

The meter is available for voltage level measurements with direct reading in neper or decibel, but also for measuring power levels in dBm or Npm.

Due to its exact reproducibility of frequencies, its high frequency stability and sensitivity, the selective level meter is suitable for measuring pilot levels. In-service check and supervisory measurements at multichannel carrier systems (e.g.V960) can be carried out when the measuring pilot frequencies lying between the bands are transmitted together with the speech signals. The pilot level measurement provides an insight into the condition of the transmission section measured, thus offering the facility for carrying out correction and maintenance work in due time.

It is also suitable for investigating the harmonics or for determining assigned channels within a frequency band.

1.1.2. Measurements with the Probe

For high-impedance measurements a special probe can be connected to the level meter - probe (B2015) 1:1, input impedance greater than 10 kΩ; associated plug-in divider (B2050) with an attenuation of 30 dB input impedance greater than 100 kΩ. The level meter in particular also permits selective voltage and level measurements as have to be carried out in routine laboratory work concerning development problems and production control. Due to provision for bandwidth changeover from 3.1kHz to a mere 80 Hz and the

high frequency stability, individual frequencies out of a composite-frequency wave can also be measured quickly and safely. The level meter can therefore be universally applied in development, production and routine maintenance checks.

1.1.3. Layout of a Level Measuring Setup

The level meter is specially designed to form a complete level measuring setup including level oscillator W2006, the level meter passing two sync signals to the level oscillator. Tuning of the latter to the measuring frequency is subsequently only carried out from the level meter. Selective measurements can therefore be made as simply and rapidly as wideband level measurements. At the same time, however, measuring errors due to mistuning are also avoided.

Level measurements are generally made in an unbalanced circuit via coaxial cables. With the aid of balancing transformers, measurements on balanced test specimens can also be performed in the same manner.

The measuring options mentioned show that, using the selective level meter and the associated level oscillator, all essential characteristics of carrier equipment and carrier systems can be rapidly and accurately covered during development, testing, maintenance, and fault location.

Owing to these properties, and the light-weight but rugged 19-inch design style, the level meter is in particular also suitable for equipping instrument trolleys, especially since the meter can be operated on batteries without using extra facilities, so that measurements can be made along the routes of operating systems in a simple manner.

1.2. Electrical Data

Frequency range . . . . . 10 kHz to 17 MHz

measuring frequency setting . . . . . $f_m = f_1 + f_2$

coarse control f_1

in spectrum steps of 100 kHz . . . . . 0 to 17 MHz

or continuously . . . . . 0 to 17 MHz

fine control f_2

continuously . . . . . −10 to +110 kHz

scale division spacing . . . . . 500 Hz

minimum readable frequency increment . . . . . approx. 100 Hz

Frequency error

f_1 with spectrum lock-in, f_2 continuously controlled . . . . . $\pm 2 \times 10^{-5} \pm 300$ Hz

variation of the lock-in frequency

with an operating voltage fluctuation of ±10% . . . . . $\pm 1 \times 10^{-7} \pm 5$ Hz

Automatic tuning system

tuning the frequency of the level oscillator from the level meter for . . . . . f_1 and f_2

	Calibration as referred to: 0 dB ≙ 0.775 V 0 dBm ≙ 1 mW (into Z)
Measuring range	
related to zero instrument mark, can be switched	
in steps of 10 dB each	−90 to +10 dB −80 to +20 dBm
minimum measurable (readable) level	−100 (−110) dB −90 (−100) dBm
Measuring error	
at the reference values 0 dB, instrument at zero, 100 kHz and $Z_i = Z = 75\ \Omega$	±0.1 dB
frequency response, referred to 100 kHz	
up to 12.5 MHz	±0.1 dB
up to 16 MHz	±0.2 dB
up to 17 MHz	±0.5 dB
divider error	±0.1 dB
indicator change when the operating voltage fluctuates by ±10%	±0.02 dB

Typical Overall Measuring Error . . . . . ±0.2 dB

in the range . . . . . −80 to 0 dB
at input . . . . . coaxial, $Z_i = Z = 75\ \Omega$
in the frequency range . . . . . 10 kHz to 12.5 MHz
when: power supply . . . . . nominal voltage ±10%
ambient temperature . . . . . +15 to +35 °C

Internal impedance, one side grounded . . . . . 75 Ω

with probe B 2015 . . . . . high impedance

Selectivity	narrow band	wide band
can be switched to		
pass band with $\Delta a = 0.5$ dB	±20 Hz	±800 Hz
bandwidth with $\Delta a = 3$ dB	80 Hz	3.1 kHz
stop-band attenuation $\Delta a > 60$ dB at	±500 Hz	±10 kHz

Residual distortion attenuations a_{k2} and a_{k3}

when the sensitivity is increased by 50 dB . . . . . ≧ 70 dB

DC output (when instrument is at full deflection) . . . . . 100 µA or 250 mV at 2.5 kΩ

Earphone output (single-sideband output), can be switched to . . . . . upper or lower sideband

IF output 100 kHz (e.g. for digital level meter D 2010)
output level across Z = 600 Ω . . . . . max. 0 dB
intensity range for the input level . . . . . approx. 100 dB

Mains connection, with "protective-grade" insulation . . 99 to 132 V and 198 to 264 V; 47 to 63 Hz; approx. 20 VA

Battery connection, with automatic switching between . . . . . 12 and 24 V; approx. 16 W
Battery may be grounded at the positive or negative pole

1.3. Functioning

1.3.1. Overall Function

The level meter D2006 operates in accordance with the heterodyne principle with triple frequency translation. The meter covers continuously the entire frequency range of 10 kHz to 17 MHz without band switching. The oscillators G1 with the coarse control f1 (MHz) and G2 with the fine control f2 (kHz) for the first and the second translation are similar to the corresponding units of level oscillator W2006 concerning their tuning ranges and layout. Using an attenuator, the input sensitivity of the level meter can be set in steps of 10 dB to cover a wide range.

An inductor-type or crystal band-pass filter may be optionally connected between the third modulator and the 100-kHz IF preamplifier. This band-pass filter determines the selectivity of the level meter. According to the speech band, the wide filter has a 3-dB bandwidth of 3.1 kHz, and is also suitable for measuring channel noise; the narrow filter - particularly suited for measuring individual frequencies from a frequency spectrum - has a 3-dB bandwidth of 80 Hz, which corresponds to a 0.5-dB bandwidth of $\pm$20 Hz.

Three outputs are available for connecting attachments:

(1) A voltage with a frequency of 100 kHz proportional to the input level within a wide range can be derived from the "dynamic output".

(2) The "recorder output" is used for connecting commercial-type graphic recorders with 100 μA and a terminal resistance of 2.5 kΩ or with 250 mV full-scale deflection and a high input resistance.

(3) Via the "single-sideband output" the voltage to be measured or a voice channel translated to the VF range can be monitored, in which case optional switching to normal or inverted position is possible.

A probe (B2014), which can be operated at an input jack provided for this purpose, is used for high-impedance measurements. Using a plug-in amplifier, the sensitivity can be increased by 20 dB, so that, for instance, crosstalk attenuation up to 120 dB can be measured. The plug-in amplifier is fed via the probe jack of the device.

For power supply the meter can be connected to an ac mains (100 to 132 V/200 to 264 V) or to a battery (12/24 V). In the case of mains connection and battery operation, voltage fluctuations within the voltage range selected are automatically offset. In battery operation, automatic transfer from 12 to 24 V is ensured.

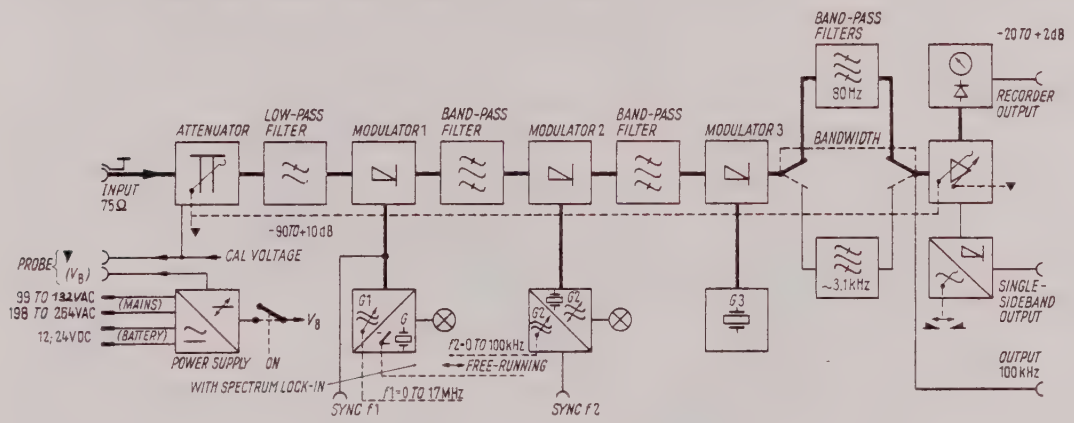
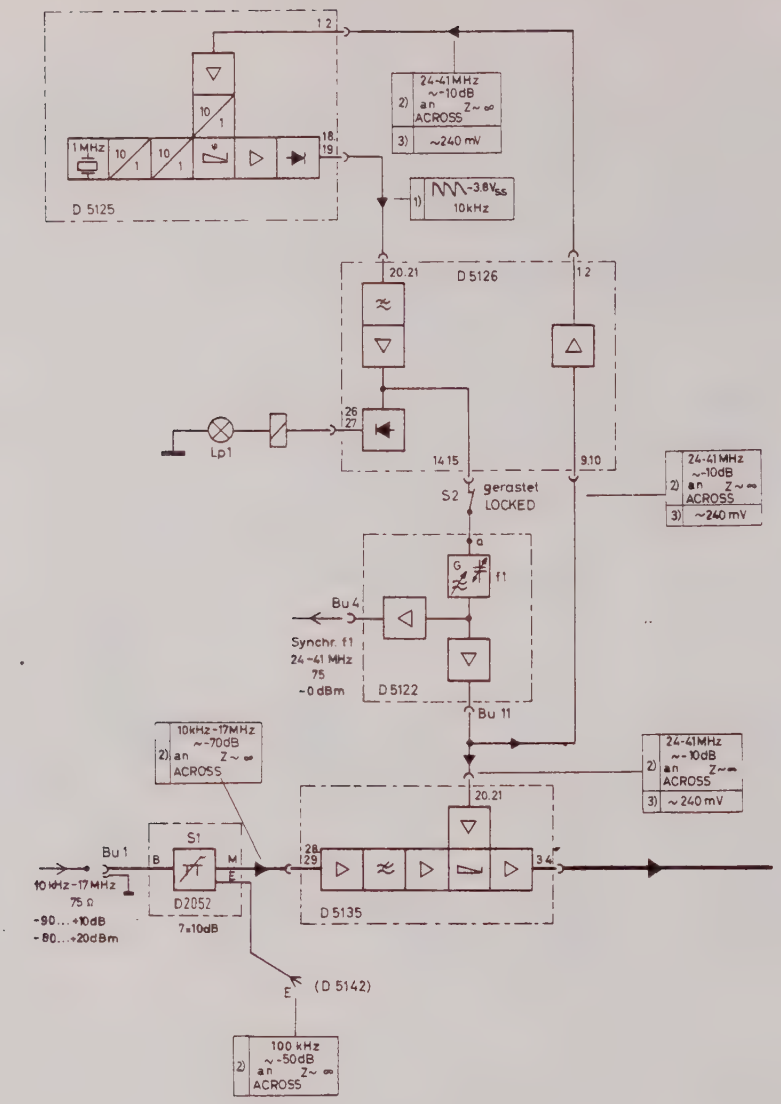


Fig. 2 General block diagram of level meter D2006

The stable, self-supporting design of the level meter as well as the application of semiconductors and integrated circuits have led to a modern compact unit of low weight, the advantages of which become evident particularly during application on the route.

The high mechanical stability obtained with the design chosen and the careful electrical dimensioning of the circuits, together with the measures taken for voltage and gain stability, guarantee an extraordinary frequency stability, so that even with the very narrow bandwidth, reliable and unambiguous level measurements can be carried out. To this end, the precision scale drives with a vernier setting free from backlash and the long scales ensure an optimum reproducibility of given frequencies.



The application of integrated circuits and the extensive use of printed circuits reduce repair measures and facilitate fault location.

Fig. 3 shows a detailed block diagram specifying the individual stages of level meter D2006; this facilitates the insight into the functioning mode described below and into the interworking of the individual subassemblies.

See also general circuit diagram for level meter D2006 (S45035-D2006-B102-+-7411) with level data.

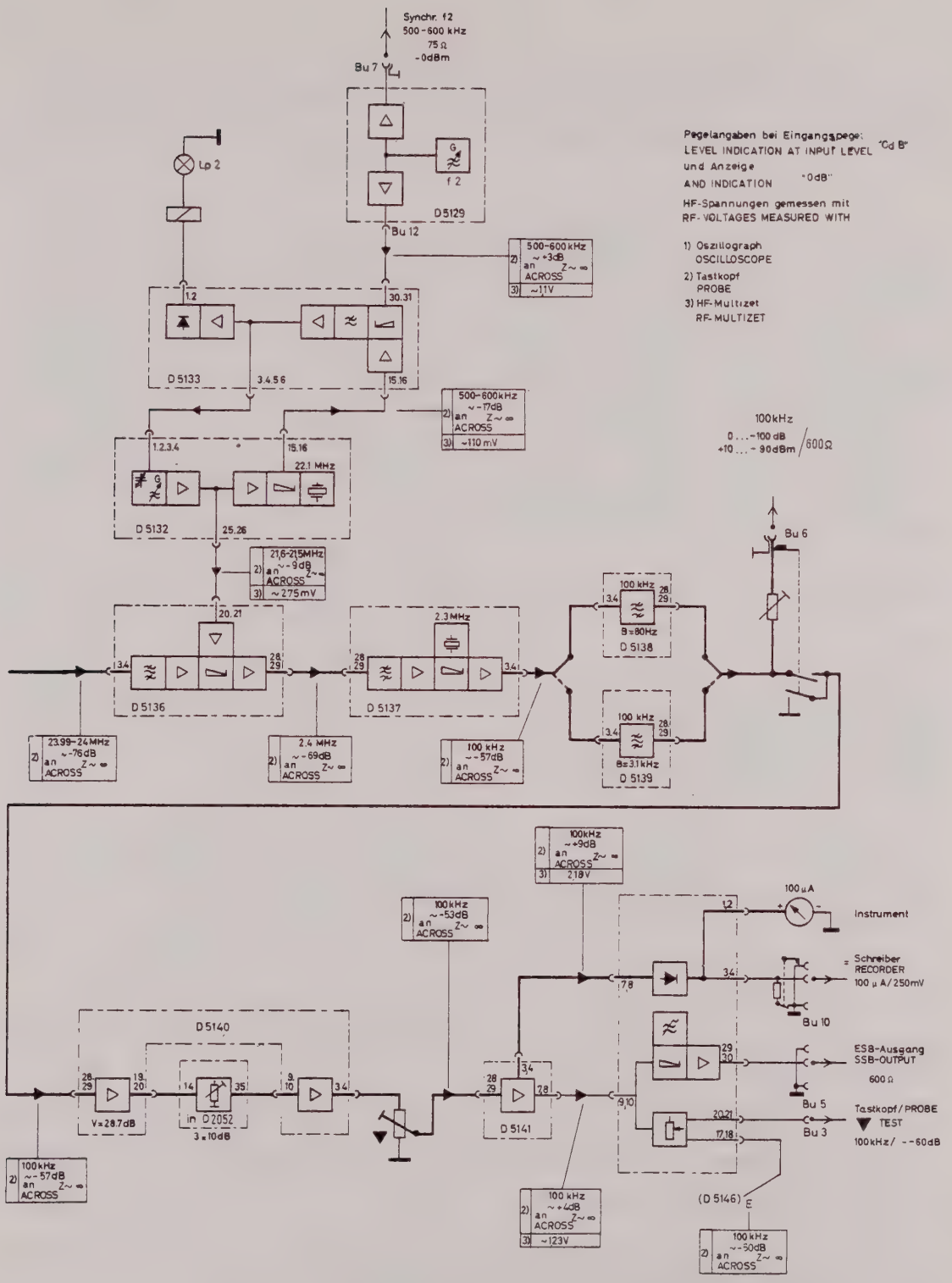


Fig. 3 Block diagram of level meter D2006

1.3.2. Oscillator f1 (S45035D-D5122-A701)

This oscillator provides a voltage in the frequency range of 24 to 41 MHz for translating the input frequency of 10 kHz to 17 MHz of the level meter.

Transistor Ts1 and resonant circuit L1, C8, C10 to C15 operate as an oscillator. By tuning C13 on the scale drive "MHz" the frequency can be varied from 24 to 41 MHz. According to the variation range, the scale is directly calibrated in input frequency values of 0 to 17 MHz. The elements of the resonant circuit have been selected for optimum temperature compensation of the resonant frequency. Varactor Gr3 has been provided for automatic frequency control according to the crystal frequency harmonics (n x 10 kHz) in locked-in operation.

Transistors Ts2/3 amplify the signal. Backward regulation to the base of the oscillator transistor Ts1 ensures a stable amplitude. The relatively high impedance and capacitance values in the regulating rectifier circuit Gr1/2 require an impedance-converter stage Ts4 in the regulating voltage circuit for impedance matching to the low-impedance base circuit of Ts1.

When a level measuring setup is composed of level oscillator W2006 and level meter D2006, the heterodyning frequencies of both oscillator units f1 and f2 are provided by the level meter. For fault-free extraction of the sync signal f1, the oscillator unit f1 is followed by a two-stage transistor amplifier Ts5/6, which passes the signal (24 to 41 MHz) to the corresponding output jack on the front panel.

For reaction-free extraction of the signal for application to the next subassembly (S45035-D5126-A701) a two-stage buffer amplifier Ts7/8 has been provided.

1.3.3. Filter/Amplifier (S45035-D5126-A701)

The two transistors Ts5/6 in subassembly D5126 function as a buffer stage for the oscillator signal f1. To ensure adequate isolation from the rest of the circuitry, this amplifier has

been mounted into a separate subassembly together with the filter circuit. The following subassembly S45035-D5125-A701 accepts the signal for further processing.

The filter circuit produces the regulating voltage for spectrum lock-in of the oscillator G1 (f1). For this purpose, the sawtooth wave from the phase modulator circuit (S45035-D5125-A701) is passed through a low-pass filter (TP) having a cutoff frequency of 5 kHz. Whenever in tuning the oscillator G1 through its range the frequency f divided in a ratio of 10:1 approaches a 10-kHz crystal harmonic, a difference frequency is produced, which, from 5 kHz onwards, falls into the pass band of the low-pass filter and becomes zero as the tuning process goes on, so that a constant regulating dc voltage is finally applied to varactor Gr3 via the dc amplifier Ts1.

However, as long as a residual detuning condition persists, oscillator G1 is swept by the regulating voltage produced at the rate of the difference frequency until, due to overshoot in the regulating loop (time constant) at a difference frequency of approx. 1 kHz (10 kHz as referred to the oscillator because of the 10:1 frequency division), oscillator G1 will have been 'caught' in the lock-in condition and crystal-accurate lock-in will have taken place.

When the circuit has not yet reached the lock-in position, an ac voltage (difference frequency) lies at the following indicating circuit Ts2 to Ts4 instead of the regulating dc voltage, and relay A2 remains operated. Lamp Lp1 on the front panel does not light in this case. Conversely by burning the lamp indicates that oscillator f1 is operating in the locked-in condition.

In order to protect oscillator G1 from disturbing reactions due to undesired frequency components from the phase modulator, an additional band-stop filter (120 dB), R35 to 39, etc., is connected to the output of transistor Ts1.

1.3.4. Oscillator/Scaler/Phase Modulator (S45035-D5125-A701)

For setting and stabilizing the oscillator G1 (f1) at the accurate frequency, a corresponding regulating voltage must be produced for varactor Gr3 provided for this purpose. This is done in a phase modulator Ts4/5 by comparing the oscillator frequency, divided from 24 to 41 MHz down to 2.4 to 4.1 MHz, with the 10-kHz harmonic of a crystal frequency.

In order to obtain a frequency divided in the ratio 10:1, the signal of 24 to 41 MHz is further amplified by Ts9/10 and passed to a transistor gate Ts11 to 13 which, via the clock input, controls four synchronously operated, integrated flip-flop circuits, acting as a decadic scaler. The resulting signal of 2.4 to 4.1 MHz lies at the phase modulator, which is simultaneously offered the 10-kHz harmonics of a 1-MHz crystal frequency (Ts1) via two cascaded integrated 10:1 frequency scalers, IC1 and IC2, and two pulse-shaping stages Ts2/3. From these harmonics the phase modulator forms a periodic wave; upon amplification in Ts6 to Ts8 and rectification with Gr3/4 and the associated resistors and capacitors, a quasi-sawtooth curve results, having a period duration of 100 µs. When the oscillator frequency deviates from the crystal harmonic, the cycle duration - deviating from 100 µs - assumes correspondingly different values; the sawtooth wave has been modulated with the difference frequency. It appears at the input of the following subassembly (S45035-D5126-A701).

1.3.5. Oscillator f2 (S45035-D2129-A701)

This oscillator is tuned with the drive of the kHz-scale of the level meter. With the 100-kHz frequency variation of 500 to 600 kHz an interpolation of the frequency setting of the level meter can be carried out between two adjacent 100-kHz spectrum lock-in points of oscillator G1 (f1) of the MHz-scale.

Since the frequency error of this oscillator (and the crystal frequency error) directly affects the overall frequency accuracy, a favorable frequency position of 500 to 600 kHz has been se-

lected. In this frequency range the required frequency stability of ±300 Hz can be obtained with reasonable design effort. In order to reach the high frequency position required for the translation in modulator 2, the 100-kHz frequency variation is translated to the range of 21.6 to 21.5 MHz with the aid of an oscillator unit G3 capable of synchronization.

The variable capacitor C16 in oscillator f2 is coupled with the vernier-type scale. This is calibrated from 0 to 100 kHz in accordance with the interpolation between two 100-kHz divisions on the f1-scale. The rest of the circuit elements is designed for optimum temperature compensation of the oscillator. In synchro-tuned operation of frequency f2, the buffer amplifier Ts2 passes the signal to the oscillator unit f2 of level oscillator W2006 without reaction. In addition, the buffer amplifier passes the signal of 500 to 600 kHz (also reaction-free) to the following modulator stage Gr1/2 in subassembly S45035-D5129-A701.

1.3.6. Phase Modulator/Search Oscillator and Oscillator/Modulator (S45035-D5133-A701 and S45035-D5132-B701)

Together with the oscillator signal of 500 to 600 kHz, the phase modulator Gr1/2 (D5133) receives a similar signal of 500 to 600 kHz from a modulator Gr3 to 6 (D5132) via Ts1/2. This second signal is formed by mixing a crystal frequency of 22.1 MHz with the frequency of 21.6 to 21.5 MHz of oscillator Ts6/Gr7 (D5132) as the difference frequency. See block diagram of the level meter.

If, due to temperature and voltage variations, for instance, the frequency of oscillator Ts6/Gr7 deviates from the nominal value, a difference frequency deviation also appears in modulator Gr1/2. The input of the following transistor circuit (D5133) - designated as search oscillator - becomes complex due to the ac voltage offered, and circuit Ts3/4 produces waves at approx. 50 Hz. This frequency of 50 Hz is used to sweep the varactor Gr7 of oscillator Ts6/Gr7; as a result of lock-in, frequency regulation is initiated until the difference frequency disappears and dc voltage

appears at the input of the search oscillator, which suppresses further oscillations, i.e. the oscillator frequency of 21.6 to 21.5 MHz is synchronized by the continuously-tunable oscillator G2 (f2) and has the same variation range of 100 kHz. Locking-in of oscillator Ts6/Gr7 is effected at approximately 200 kHz, i.e. with a 200-kHz deviation of the frequency for varactor Gr7 swept at a rate of 50 Hz.

The signal of 21.6 to 21.5 MHz is passed on to subassembly "modulator 2" (S45035-D5136-A701) via Ts7.

As long as oscillator Ts6/Gr7 has not reached synchronism, a 50-Hz wave is produced in the search oscillator as described above. This ac voltage is processed by the following rectifier circuit Gr3/4 (D5133). The resulting dc voltage controls relay A1 via the two transistors Ts5/6, so that the lamp on the front panel lights up. If, however, within the lock-in and holding range, 50-Hz oscillations are no longer produced, no corresponding dc voltage is available for controlling the relay, and proper lock-in of the oscillator frequency f2 is indicated by the extinction of the front panel lamp.

1.3.7. Attenuator (S45034-D2052-B111)

A well-defined attenuation of the test signal is required for exact level measurements. This is achieved by the attenuator in 10-dB steps of 0 dB to -70 dB respectively (in the sensitivity range of -10 to -80 dB respectively) with the corresponding number of switch positions at a stable input impedance of 75 Ω. In addition to the division effected at the input, the divider switch also switches the 100-kHz IF channel level. For level calibration of the level meter and for calibrating the probe, the 100-kHz calibrating signal from the 100-kHz amplifier is additionally applied to the input of modulator 1 in the switch positions provided for this purpose.

1.3.8. Modulator 1 (S45035-D5135-A701)

In modulator 1 the test signal (10 kHz to 17 MHz) is translated to the range of 24 to 23.9 MHz with the oscillator frequency f1 of 24 to 41 MHz.

For this purpose, the test signal arriving from the calibrated divider is passed to the modulator diodes Gr1 to Gr4 via an impedance transformer Ts1, a low-pass filter with cutoff at 17 MHz, and another impedance converter Ts2/3. The fundamental carrier (control frequency) of 24 to 41 MHz reaches the modulator transformer Ü1 via two buffer stages Ts6 and Ts9 and the Schmitt trigger Ts7/8. For maximum stability of the amplification of the test signal stabilizing circuit measures have repeatedly been taken in the stages for the further handling of the signal, e.g. with Zener diodes and Thernewid thermistors.

The desired mixing product of 24 to 23.9 MHz is already amplified with Ü3/C21 in the following buffer amplifier Ts4/5 and passed on to subassembly S45035-D5136-A701.

1.3.9. Modulator 2 (S45035-D5136-A701)

In modulator 2 the measuring signal translated to the range of 24 to 23.9 MHz is mixed a second time, so that a fixed frequency of 2.4 MHz results with the oscillator frequency in the band of 21.6 to 21.5 MHz.

Selection of the measuring signal on the basis of the first translation with f2 is carried out in the 24-MHz band-pass filter. Subsequently, impedance matching is performed with Ts1/2 and the signal finally translated in modulator 2 with the frequency of 21.6 to 21.5 MHz arriving via the buffer stage Ts4. A parallel-resonant circuit Ü3/C13 provides for pre-selection of the desired mixing product (2.4 MHz), which passes to the next subassembly S45035-D5137-A701 via a further impedance converter stage Ts3.

1.3.10. Modulator 3 (S45035-D5137-A701)

After the first translation of the measuring signal a bandwidth of more than 100 kHz was still required in accordance with the remaining variation of the input frequency of 100 kHz. At the 2.4-MHz intermediate frequency, further selectivity can now be aimed at on the basis of the 100-kHz variation of the oscillator frequency f2. According to the desired properties of the level meter, a bandwidth of 80 Hz and a voice-frequency bandwidth of 3.1 kHz can be obtained. To achieve this, further translation to a frequency of 100 kHz will be required.

For translation in modulator 3, the 2.4-MHz signal is applied to rectifier Gr1 to 4 via the 2.4-MHz band-pass filter and the impedance converter. A crystal oscillator provides a frequency of 2.3 MHz, whose amplitude is stabilized with Zener diode Gr6. To obtain a stable gain of the 100-kHz signal, the base of transistor Ts2 is stabilized with Gr5 (Zener diode).

1.3.11. 100-kHz Crystal Band-pass Filter (80 Hz) (S45035-D5138-A701)

Three crystals Kr1 to 3 with the associated switching elements form a 100-kHz band-pass filter having a bandwidth of only 80 Hz and a 0.5-dB pass band of $\pm$20 Hz.

Via a buffer stage Ts1 the signal is extracted for application to the 100-kHz preamplifier (S45035-D5140-A701). Furthermore, a 100-kHz voltage proportional to the input level is available via the "dynamic" output Bu6 on the front panel. When a plug is connected to Bu6, the following 100-kHz preamplifier is separated from the signal.

1.3.12. 100-kHz Inductor-type Band-pass Filter (3.1 kHz) (S45035-D5139-A701)

At the bandwidth of 3.1 kHz, it has been possible to compose this band-pass filter from inductors and capacitors. Two cascaded triple-tuned band-pass filters are separated by an amplifier stage Ts1. The temperature coefficient of the inductors is

compensated for with a Thernewid thermistor R8.

A buffer stage Ts2 following the band-pass filter and the "dynamic" output correspond to the crystal band-pass filter.

1.3.13. 100-kHz Preamplifier and Final Amplifier (S45035-D5140-A701 and S45035-D5141-A701)

In order to have an adequately high voltage available for the various outputs of the level meter and for indication, the 100-kHz signal from the band-pass filters is further amplified in the two cascaded subassemblies D5140 and D5141.

A Zener diode Gr1 performs a stabilizing action against voltage variations both in the preamplifier and in the final amplifier. The very wide input voltage range of -90..+10dB requires an additional gain control in the preamplifier to be switched with the input divider.

The final amplifier passes an amplified signal to the band-pass filter U1/C12, which suppresses the white noise content above and below the band.

1.3.14. Output Section (S45035-D5142-A101,201)

The final amplifier ultimately passes the 100-kHz signal via two leads to the different circuits in this last subassembly.

Diodes Gr1 to Gr3 produce a dc voltage proportional to the input level; this is used for indicating the level at a 100-/uA instrument and is also available at the output jack Bu10 for operating a graphic recorder (100/uA, 250 mV).

A stabilized voltage (100 kHz) for calibrating the meter and the probe can be derived from Bu3 via transformer Ü2. This permits recalibration by reference to the red scale division on the level instrument.

During service measurements in carrier multiplex systems, the signal translated to the VF position can be monitored at the SSB output. In this case, Ts1 functions as a modulator for the incoming 100-kHz frequency with the associated sidebands. An oscillator Ts4 - with its frequency offset by the sideband frequency - provides the mixing frequency, by means of which the sideband frequency of 1.85 kHz is ultimately obtained; using S4, the normal or inverted position can be selected, i.e. the lower or upper sideband, by switching the oscillator capacitances.

1.3.15. Power Supply (S45035-D5143-B701)

The power supply caters for the overall power supply of the transistor stages of the meter, processing ac mains or battery voltages. It consists of a power transformer Tr1 with bridge rectifier Gr1, a dc/dc converter, and three regulating stages for the dc voltages produced, i.e. +16 V, +5.5 V and +24 V. A mains fuse (fuse link) protects the device against damages due to overload.

The primary of power transformer Tr1 has been tapped, so that an adjustment to 100 to 132 V or 200 to 264 V can be effected. In the case of mains operation, the bridge rectifier Gr1 feeds the transistor circuit Ts1 to 3, which functions as an oscillator, passing a 20-kHz voltage to transformer Ü1 also laid out for 20 kHz. The secondary voltages of this transformer are rectified and provide the input voltages for the three regulating stages.

If the device is operated on a battery, the battery voltage feeds the transistor oscillator Ts1 to 3 instead of the dc voltage supplied by bridge rectifier Gr1. A rectifier type Gr1 arranged in the battery voltage input blocks when the battery is connected with reversed polarity. Switching between the battery voltages of 12 V and 24 V is effected automatically at the primaries of transformer Ü1 with the aid of relay A.

The voltages provided by the dc/dc converter, which consists of the 20-kHz oscillator and transformer Ü1 with rectifiers Gr3 to 8, form the operating voltages via the series-arm transistors Ts6/9, Ts10 and Ts3/8 with the associated regulating transistors Ts5, Ts2. Transistors Ts4 and Ts7 with the associated resistors between base and emitter act as protective units against overload when an operating voltage is short-circuited; when, for instance, the current through R9 increases to more than 1 A, the voltage drop at the resistor blocks the remaining transistors via the emitter-to-base junction of Ts4. In order to obtain a stable reference voltage required for regulation, Zener diodes (Gr2 to 5) are included in the regulating path.

1.4. Accessories, Dimensions and Weights

Description	Order No.	Dimensions in mm	Approx. weight in kg
Level Meter D 2006 (10 kHz to 17 MHz)			
Model –100 to +10 dB	S45034–D2006–C102	448 × 284 × 253 each one	14
Model –90 to +20 dBm	S45034–D2006–C204		
Model –100 to +10 dB	S45034–D2006–B102		
Model –90 to +20 dBm	S45034–D2006–B204		
Accessories			
1 power cord	V45594–F4– A222	1500	0.3
1 battery connecting cord	V45257–R3003	1500	0.3
Optional			
Coaxial connecting cords 4/13, Z = 75 Ω	see data bulletin B 1002		
Battery power supply B 2064		144 × 178 × 202	5.5
Probe B 2015		448 × 282 × 106	6
Plug-in amplifier	upon request		

2.1. Control Units

2.1.1. Control Units on the Front Panel

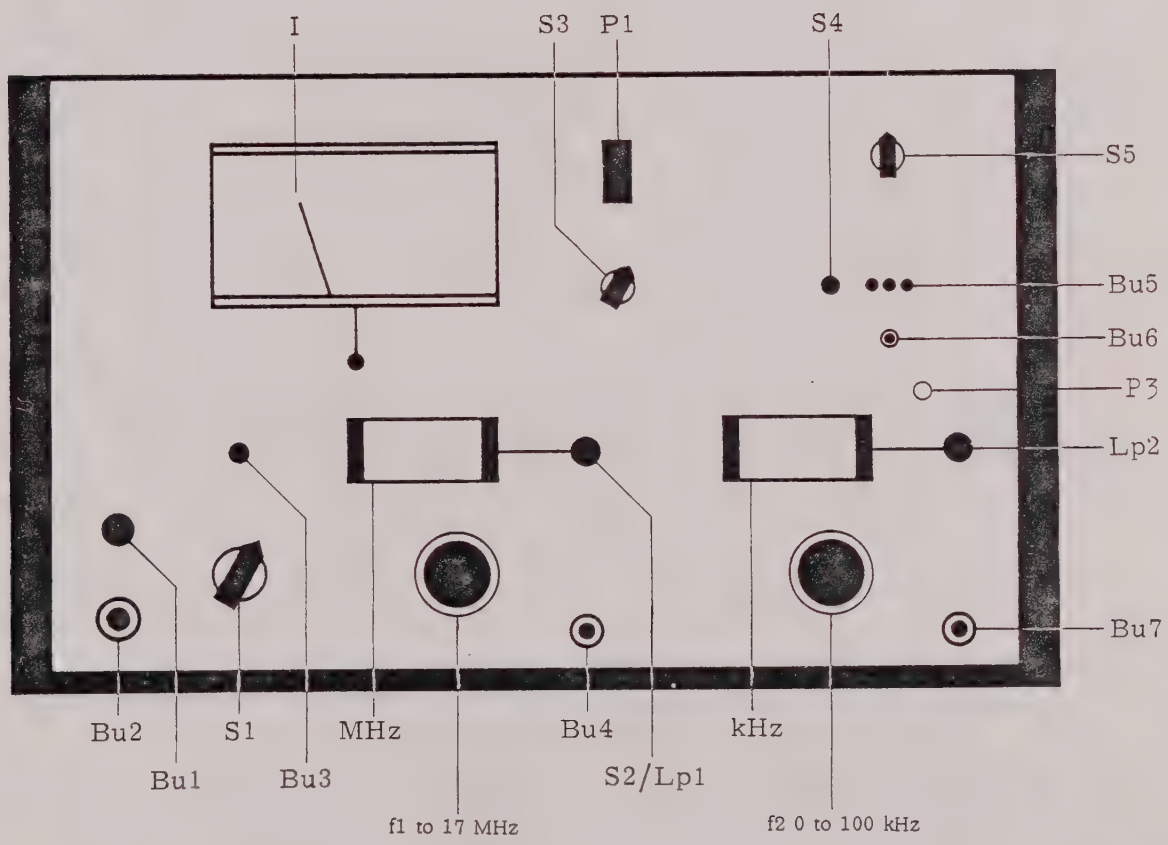


Fig. 4 Level meter D2006 (front panel)

2.1.2. Control Units at the Rear

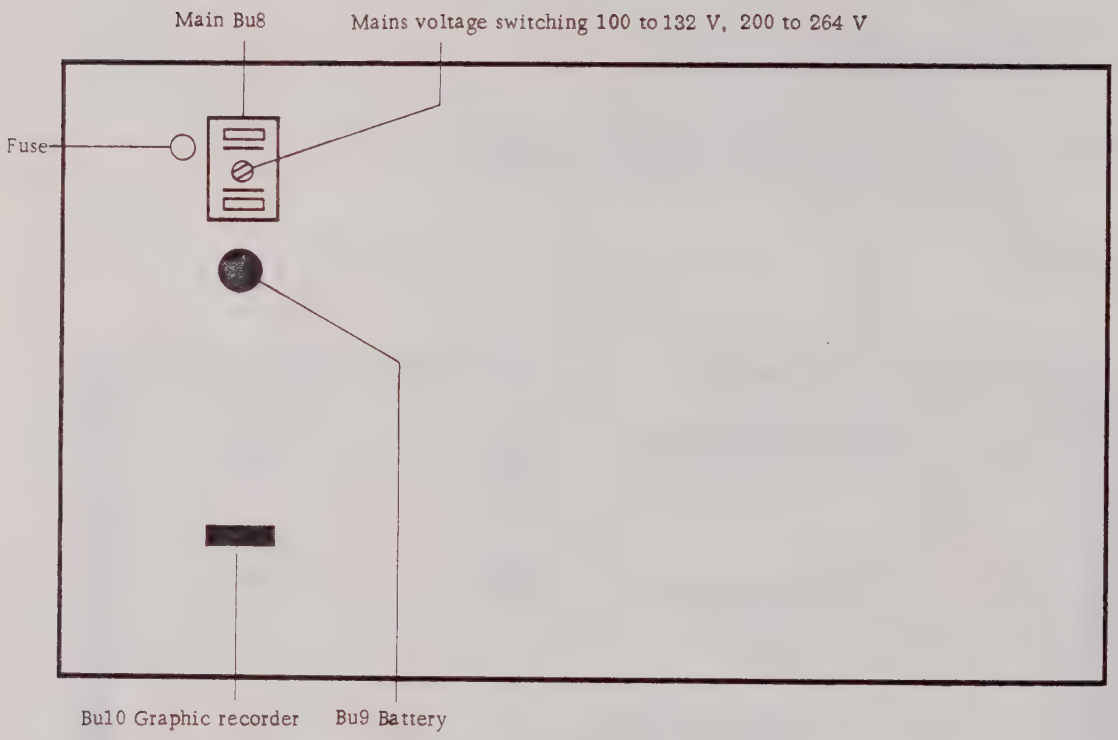


Fig. 5 Level meter D2006 (rear view)

2.1.3. Control Units for Putting into Operation

(Figs. 4 and 5)

Mains socket	Bu8	For connection to the mains, with protective insulation; ac voltages 100 to 132 V, can be switched to 200 to 264 V, 47 to 63 Hz, approx. 20 VA (adjustment to supply voltage by turning the screw in the mains socket; Fig. 6).
Fuse		For exchanging the mains fuse see 2.2.1, Page 2-7
Battery socket	Bu9	For connection to the battery, automatic switching between 12 V and 24 V, approx. 16 W; battery grounding optionally to plus or minus (Fig. 5).
Switch ON-OFF	S5	For mains and battery operation

2.1.4. Control Units for Frequency Setting and Synchro-tuning

f1-control		Frequency setting of main scale between 0 and 17 MHz
Frequency scale f1	MHz	Main scale, 100 kHz between divisions
Key "locked-in/ free-running"	S2/Lp1	Illuminated turnkey for selecting the operating mode of the oscillator frequency f1 ('locked-in' or 'free-running'). The lamp in the key lights up at each 100-kHz lock-in point of the frequency scale f1 in accordance with the crystal-accurate 100-kHz spectrum lock-in action.

Synchronization output	Bu4	Output jack for the frequency f1 (24 to 41 MHz) for synchro-tuning the level oscillator W2006
f2-control		Frequency setting (coarse and fine) of the vernier-type scale, -10 kHz to +110 kHz
Frequency scale f2	kHz	Vernier-type scale, 500 Hz between divisions
f2 fault indicator	Lp2	Lamp indication when oscillator frequency (f2) is no longer locked to the crystal frequency (internally)
Synchronization output f2	Bu7	Output jack for the frequency f2 (500 to 600 kHz) for synchro-tuning the level oscillator W2006
Frequency correction f2	P3	Potentiometer for correcting the synchronization frequency f2

2.1.5. Control Units for Measuring Voltage, Recorder Connection and Bandwidth

Attenuator	S1	Setting of the measuring level, adjustable in steps of 10 dB in the ranges of: -90 to +10 dB -80 to +20 dBm
Level calibration	P1	Control for calibrating the level meter and probe levels at instrument I (red mark) in the calibrating position of the calibrating divider switch S1 (red triangle)
Input	Bu1	Coaxial input jack of the level meter (4/13), outer conductor grounded

Instrument	I	Indication of measuring level (additive to calibrating divider setting S1). Setting the mechanical instrument zero at the screw below the instrument on the front panel
Bandwidth	S3	Bandwidth switch (3-dB bandwidth):80 Hz or 3.1 kHz (speech bandwidth)
Graphic recorder	Bu10	Output jack for connecting a graphic level recorder (100 uA or 250 mV)

2.1.6. Jacks for Connecting the Probe

Probe jack	Bu2	Output jack for the power supply of the probe
100-kHz calibrating signal	Bu3	Output jack for the 100-kHz signal for calibrating the probe (S1 to red triangle)

2.1.7. Control Units for SSB Supervision

SSB output	Bu5	Output jack 1.85 kHz for upper or lower sideband, depending on the position of switch S4
Switch "upper/lower sideband"	S4	Switch for the selection of upper or lower sideband to jack Bu5

2.1.8. Jack for the Dynamic Output Voltage

Dynamic output	Bu6	100-kHz output jack, level proportional to the input level. The output only indicates voltage values, when S1 is on the "red dot".

2.2. Putting into Operation

The level meter can be operated on ac mains or battery voltage.

2.2.1. Mains Operation

(A) When supplied, the level meter is set to the supply voltage range of 200 to 264 V. In the case of voltages in the range of 100 to 132 V, the supply voltage selector is to be switched to this range and the mains fuse to be exchanged accordingly.

(B) Connect the power cord to the rear of the meter

(C) Set ON/OFF switch on the front panel to ON ⊙

Connection to the mains is to be established with the power cord supplied. The mains end need not be grounded since the device is provided with 'protective-grade' insulation in accordance with the VDE specifications (VDE 0411). The power supply contains a fuse, which is to be replaced in the case of a change in the supply voltage (see 3. NOTES ON MAINTENANCE), i.e. 0.63 A for 110 V and 0.315 A for 220 V. The meter leaves the factory set for a supply voltage of 220 V and with the necessary fuse. A change to the supply voltage range between 100 and 132 V is

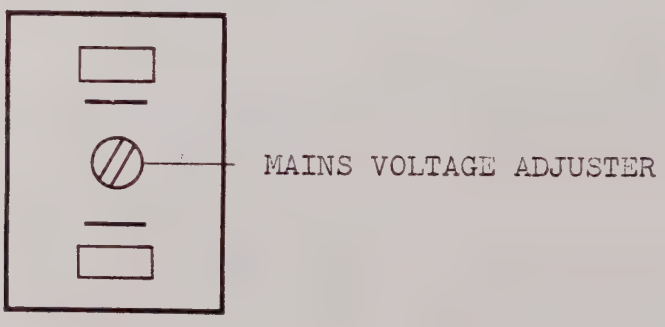


Fig. 6 Mains voltage adjustment

performed by rotating the screw head in the mains socket. After unscrewing the fuse holder cap the fuse can be easily replaced.A fuse link for a supply voltage of 100 to 132 V (0.63 A) and spare lamps included in a bag are supplied with the level meter.

2.2.2. Battery Operation

(A) Connect battery cord to jack Bu9 at the rear of the device. Battery voltage 12 V or 24 V.

(B) Set ON/OFF switch on the front panel to ON ⊙

The dc/dc voltage converter included in the power supply unit automatically switches between 12 or 24 V depending on the connected battery voltages, producing the operating voltage required for the subassemblies by means of the rectifier and regulating section. The battery connection is ungrounded; the minus voltage is connected to terminal 1 of the 5-pole jack and the plus voltage to terminal 2. A built-in diode protects the level meter against damage in the case of wrong polarity. Since the active components of the level meter are transistors and integrated circuits throughout, the power input is only about 16W.

A battery simultaneously connected during mains operation will not be charged. To ensure reliable battery operation of the level meter, provision must be made otherwise for proper charging and maintenance of the battery.

The battery power supplies B2062, B2064 and B2069 were especially developed for mains-independent battery operation of the level meter D2006 and the level measuring setup D2006/W2006. They incorporate a charger for battery re-charging on the mains.

2.3. Layout of a Level Measuring Setup

Together with the level oscillator W2006, level meter D2006 forms a complete level measuring setup for the frequency range of 10 kHz to 17 MHz. To ensure 'synchro-tuned' operation of both units, the level oscillator can be synchronized with the frequencies f1 and f2 of the variable-frequency oscillator of the level meter. The connections of the jacks f1 to f1 and jacks f2 to f2 between level oscillator and level meter must be established with the 75-Ω coaxial cables (connect Bu4 f1 on D2006 to Bu1 f1 on W2006, and Bu7 f2 on D2006 to Bu2 f2 on W2006).

In synchronized operation (f_1 and f_2) and with a bandwidth of 80 Hz proceed as follows:
Interconnect level oscillator output and level meter input. The level meter must then show the same reading in synchronized and non-synchronized operation. If the reading deviaties in synchronized operation, the pontentiometer P3 in the level meter can be turned for maximizing the level meter deflection.

There is no need for the two frequencies f1 and f2 always to be provided by the level meter for synchro-tuning. Should it be considered necessary for the measurement, either oscillator unit f1 or oscillator unit f2 of the level oscillator may be used for synchro-tuning by establishing a coaxial connection between jacks f1/f1 or f2/f2 of the level meter/level oscillator.

If only f1 is synchro-tuned, the coarse frequency setting f1 is performed on the level meter and the fine setting s2 separately on both units. In a similar manner, f1 is to be set on the level oscillator and level meter, and f2 on the level meter only, when f2 is synchro-tuned by the level meter.

2.4. Level Measurements

In addition to synchro-tuned operation with the level oscillator, the level meter can also be used independently of the level oscillator for accurate voltage and level measurements in laboratories, in test rooms, at carrier multiplex systems when, for instance, level oscillator and level meter are to be physically separated for line measurements and synchro-tuned operation is impossible. The high frequency stability and the favorable reproducibility of the frequency setting of both devices are then of particular advantage. The fundamental method to be employed in such measurements should be similar to that used with the synchro-tuned level measuring setup, with the only exception that the two coaxial connections must be omitted and frequency settings must be made both on the level meter and the level oscillator.

2.4.1. Connection to the Test Specimen

The input impedance of the level meter is 75Ω. In order not to introduce errors into the measurement, the test specimen must on principle be connected to a 75-Ω coaxial cable and, if necessary, matched to 75 Ω. For balanced specimens an appropriate balancing transformer should be used. See also description of level oscillator W2006.

2.4.2. Setting to the Measuring Frequency

The frequencies are set on the coarse (MHz) and the fine scale (kHz) of the level meter, both settings for f1 and f2 adding up when this is done. In synchro-tuned operation, the transmitting frequency of the level oscillator is set simultaneously with this setting.

The MHz-scale covers the overall range of 0 to 17 MHz. It is calibrated in 100-kHz steps. The oscillator can optionally be locked in electrically at crystal accuracy or continuously tuned (free-running oscillator unit 01). Crystal-accurate lock-in can be selected by means of the turnkey with lock-down facility beside the MHz-scale. In the frequency setting operation,

electronic lock-in already begins near the associated scale division. Nevertheless, to avoid reading errors, the scale should always be set accurately to the scale division.

In the case of level measurements without synchro-tuning, the measuring frequency must first be found, preferably at a bandwidth of 3.1 kHz (S3). To this end, the oscillator f1 is operating in the continuous tuning mode (without lock-in) and tuned through its range until, at an appropriate calibrated divider setting, a deflection maximum can be observed. In special cases, attention should be paid to harmonics of the measuring frequency because of the high input sensitivity of the level meter. Only after this coarse presetting must oscillator f1 be switched to the lock-in mode, i.e. to the next lower scale division of the MHz-scale since, using the kHz-scale (100-kHz variation), setting to the frequency value found first can now again be performed by reference to maximum deflection of the level instrument - with a bandwidth of 80 Hz, if required - and since the sum of the two readings on the scale provides the frequency value sought for. In this manner, frequency measurements can also be carried out.

FREQUENCY VALUE 6.4053 MHz

Fig. 7 Frequency setting f1 + f2

The kHz-scale can be freely tuned through 100 kHz (with an overlap of ±10 kHz) and provides the vernier-type setting between two lock-in frequencies. The spacing between scale divisions is 500 Hz.

2.4.3. Determining the Measuring Level

The level value of the signal to be measured can be determined on the basis of the instrument display and the calibrated divider setting after previously calibrating the level meter display. The measuring level results from the display value and the calibrated divider setting as follows:

Example in dB:		
	Calibrated divider setting:	-10 dB
	Scale reading:	+1 dB
	Measuring level:	- 9 dB

The measuring error of the level found can be calculated with the aid of the values indicated in the data bulletin for the level meter, in so far as errors, if any, are not negligible.

2.4.4. Selection of Bandwidth

The 3-dB bandwidth of 3.1 kHz or 80 Hz can be selected with S3. The bandwidth of 3.1 kHz nearly corresponds to that of a voice channel.

It is advisable to measure with a bandwidth of 80 Hz when the unknown frequency is adjacent to the other frequencies or when, in the case of level measurements to be carried out at maximum sensitivity, interference voltages are to be suppressed.

2.5. Measurements of Harmonic Distortion

The basic condition for accurate harmonic distortion measurements is that harmonic distortion of the level meter must be relatively low with respect to the harmonic distortion to be measured. When measuring distortion attenuation above 50 dB, the following should be observed if an adequate measuring accuracy is to be obtained:

(1) When measuring the fundamental, the input attenuator must be set for an easily readable level indication on the instrument.

(2) For measuring the harmonics, the level meter sensitivity must be correspondingly increased on the attenuator, but not by more than 50 dB.

2.6. Attenuation Measurements in the Case of Steep Filter Curves

When measuring the frequency response of attenuation on very steep band-pass filters, particular care should be taken to prevent the penetration of interfering frequencies into the measuring instrument. We therefore recommend the use of our double-shielded coaxial measuring cables in any case. Besides, steep filter curves can be measured reliably and quickly with the vernier tuning control of the level measuring setup owing to its high frequency stability and good reproducibility of the frequency setting.

2.7. Level Calibration

Prior to a measurement the gain of the level meter should be checked.

(A) Set switch (S1) to the red triangular mark "calibration"

(B) Select the lock-in mode of the MHz-scale and set it to 100 kHz (black triangle)

(C) Set kHz-scale to approx. "zero kHz" (black triangle) and, using f2, tune it for maximum deflection of the instrument

(D) Use control P1 to set the pointer deflection on the instrument accurately to the red triangular mark of the instrument scale.

Readjustment is to be carried out after an adequate warm-up period of the device of approx. 30 min; this guarantees a measuring accuracy corresponding to the performance data of the level meter.

2.8. Single-sideband Output

If also the speech band is to be observed during service measurements on carrier multiplex systems, e.g. with oscilloscope or headset, this is possible via the SSB output (Bu6). S5 can then be used for selecting the upper or lower sideband.

2.9. Dynamic Output

The output gives a 100-kHz signal, whose level varies in proportion to the input voltage and can be used for further measured-value processing. To this end, the input attenuator S1 is to be brought to the switch position marked with a red dot (circle). When the coaxial plug is connected to the dynamic output, the 100-kHz final amplifier is switched out of circuit; levels are consequently no longer displayed on the instrument and no recorder output voltage is available.

2.10. Connection of a Graphic Recorder

Via the graphic recorder output at the rear of the device, a voltage or current recorder (100 µA and 250 mV, respectively) can be operated for automatic measuring-level recording. Since, when the graphic recorder is connected, a 2.5-kΩ substitution resistor is put out of circuit which was hitherto across the output, the level indication on the instrument remains unaffected. A level of 0 dB corresponds to a voltage of 194 mV at the recorder output and a voltage of 77.5 µA, respectively. The desired recorder deflection can be set by shunt or series resistors for the graphic recorder (potentiometer).

2.11. Connecting and Calibrating the Probe

By means of the probe B2015 (1:1, input impedance greater than 10 kΩ with 100 pF in parallel) or the probe with plug-in divider B 2o50 (a = 30 dB, input impedance greater than 100 kΩ), voltage or level measurements can also be carried out at test specimens on a high-impedance basis. The level meter with probe is particularly suited for selective laboratory measurements.

Prior to a measurement, the probe is to be calibrated at a frequency of 100 kHz. After the probe has been connected to the jacks provided on the level meter, the probe tip is to be inserted into the calibrating jack "probe" Bu3, the input divider to be set to the position "▼probe", and the instrument pointer at P1 to the red scale division of the level instrument.

2.12. Measurements with Preamplifier

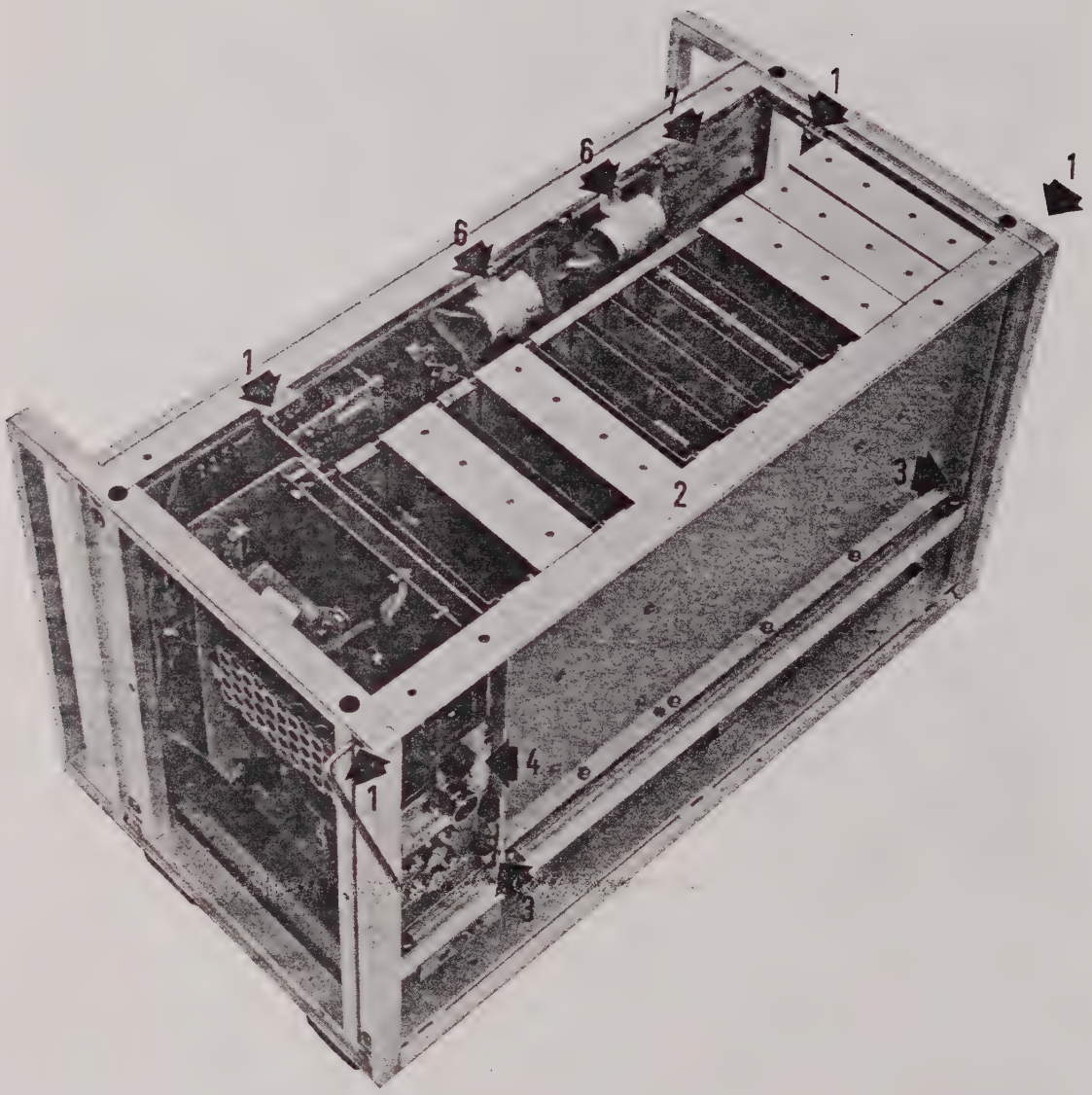
For special measuring problems, the 20-dB amplifier B 2024 can be connected to the input of level meter D 2006, which permits accurate crosstalk measurements up to 120 dB.

3. M A I N T E N A N C E

The level meter D2006 is designed in such a manner that no regular maintenance and continuous supervision are necessary. However, after a longer period of time the optimum settings of the meter could vary owing to aging of the components. The corrections required on these grounds do not call for any particular technical knowledge.

All the aligning elements are accommodated either directly behind the front panel or on the circuit boards, accessible from the top of the instrument. Aligning work should be carried out first after temperature equilibrium has been reached within the equipment unit, after approx. one hour of operation.

The maintenance and also the subsequent fault location instructions are so organized that all measuring points are accessible if the subassemblies installed in the subassembly chassis are operated via an adapter. It is merely in replacing oscillators f_1 and f_2 that it is necessary to tilt the subassembly chassis.



After removal of bolts (1) Card-Cage (2) Can be tilted out towards rear around hinges (3). (4) Fuseholder; (5) DC-DC Converter; (6) Spare films; (7) Spare parts container.

All the subassemblies are lettered, e.g. S45035-D5135-A701. In the following section, however, subassemblies mentioned are only named by their abridged designation, e.g. -D5135-. The positions of the individual subassemblies are shown on the inside of the cover plate.

3.1. Checking the Receiving Frequency

The receiving frequency of the level meter is produced by the oscillators f_1 and f_2. To measure these frequencies, a frequency counter up to 50 MHz with an absolute error of $\frac{\Delta f}{f} \leq 5 \times 10^{-8}$ is necessary.

3.2. Checking the Oscillator Frequency f_1

Connect a frequency counter to jack 'Bu4' of the level meter. Oscillator f_1 set in the lock-in mode to 15 MHz should then supply a voltage of frequency $f_{osc} = f_1 + 24$ MHz $\pm \Delta f$ (with $\Delta f \leq \pm$ 100 Hz). f_1 is the frequency set on the frequency scale f_1. If Δf exceeds $\pm$ 100 Hz but is smaller than $\pm$300 Hz, tuning to the nominal value is possible with trimmer C4 in subassembly -D5125-. If deviation Δf exceeds 300 Hz, then proceed according to section 4.6.3. of the Fault Location Instructions.

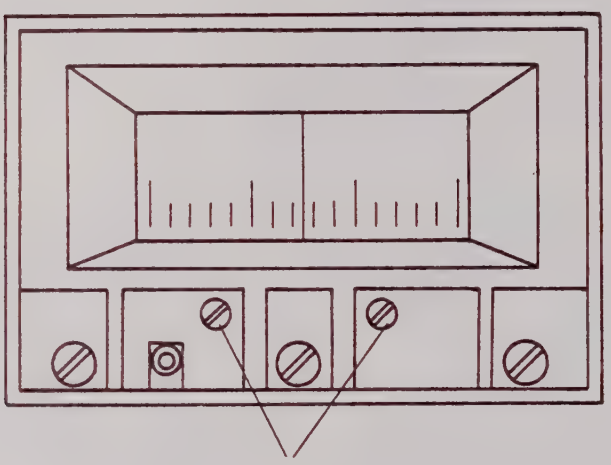
Upon switching to free-running operation of the f_1 oscillator, the deviation of the oscillator frequency from the set value, i.e. the agreement between frequency scale and frequency should be better than $\pm$ 10 kHz, hence also here

$$f_{osc} = f_1 + 24 \text{ MHz} \pm \Delta f \quad \text{with } \Delta f \leq 10 \text{ kHz}$$

If the frequency deviation Δf exceeds $\pm$ 10 kHz, then proceed according to section 4.6.2.1. of the Fault Location Instructions.

If the frequencies indicated on the counter (in the lock-in or free-running mode) appear uniformly at all the checked frequency points slightly below or above the value set on the frequency scale, respectively, this deviation can be adjusted by moving the scale window (index line). To do this, unscrew the control elements on the front side (hex socket screw

wrench for the control knobs of the film drives is in the spare parts bag), remove the front panel and loosen the two cylinder-head cap screws of the scale window f_1 (about one revolution). The index line can then be shifted.



to be loosened

3.3. Checking the Oscillator Frequency f_2

Connect a frequency counter to jack 'Bu7' of the level meter. The setting f_2 = 0 kHz on the frequency scale f_2 corresponds to a frequency of f_{osc} = 500 kHz indicated on the counter, and the setting f_2 = 100 kHz to a frequency of f_{osc} = 600 kHz. The deviation Δf between the value set on the frequency scale and the associated oscillator frequency should be smaller than $\pm$ 100 Hz, whereby $f_{osc} = f_2 + 500\ kHz \pm \Delta f$ with $\Delta f \leq \pm 100$ Hz.

Remedy a possibly present parallel shift of the frequency, as referred to the frequency scale, as in section 3.2.. If this correction range of the scale window does not suffice, the nominal value of the oscillator frequency can be set with trimmer 'C5' in the f_2-oscillator -D5129-.

If the deviation exceeds ± 100 Hz, proceed according to section 4.6.6. of the Fault Location Instructions.

If the deviation is smaller than ± 100 Hz, examine the frequency of oscillator f_2 converted to f_2' = 21.6 to 21.5 MHz at pins 25/26 of the subassembly -D5132- operated via an adapter (caution: do not waste time to avoid excessive cooling of the crystal in -D5132-). Frequency 0 kHz set on the film scale for f_2 corresponds to a frequency f_2' = 21.6 MHz appearing at the pins 25/26 of -D5132-, and a frequency f_2' = 21.5 MHz indicated on the counter corresponds to the set frequency f_2 = 100 kHz. The deviation from the nominal value f_2' must not exceed $\Delta f = \pm 100$ Hz. If $\Delta f > 100$ Hz, an alignment to the nominal value is possible with trimmer C3 of subassembly -D5132-. If the control range of C3 is not sufficient, proceed according to section 4.6.5. of the Fault Location Instructions.

3.4. Examining and Correcting the Calibrating Level

In order to check the calibrating voltage, a level oscillator in warmed-up condition with the following data is necessary:

Level oscillator: f = 100 kHz, Z = 75 Ω, level error $\Delta p \leqq 0.03$ dB
output level: according to the model of the level meter to be examined, i.e. 0 dB or +10 dBm.

Connect the output of the level oscillator via a short section of coaxial cable (Z = 75 Ω) to the input jack 'Bu1' of the level meter. With a bandwidth of 80 Hz, f_1 = 100 kHz in the lock-in mode and with the sensitivity switch at 0 dB or + 10 dBm, with control f_2 of the -D2006- to the transmitting frequency; thereafter set the reading of -D2006- with the calibrating potentiometer 'P1' accurately to the zero mark of the instrument.

Pull out the coaxial cable from the input jack, set the sensitivity switch 'S1' to the calibrating position (left-

hand stop) and tune again control f_2 for a maximum reading on the instrument. Without actuating the calibrating potentiometer 'P1', now set the instrument reading again accurately to the zero mark of the instrument with the potentiometer R27 on the subassembly -D5142- operated via an adapter.

Caution: Take care that this aligning operation is carried out as quickly as possible so that the components are not cooled down too much. Correspondingly, the cover plate of the equipment unit is to be taken down only for a short time for this alignment.

3.5. Replacing the Signal Lamps

Spare lamps, fuses, lamp extractors and a pulling hook for withdrawal of the subassemblies are found in the spare parts bag, which is accessible after removing the upper cover plate.

The indicating lamps of the equipment unit, lamp 'Lp1' in the lock-in switch 'S2' and the f_2 fault indication lamp 'Lp2' are in bayonet holders under the red cap near the f_2-film scale and can be removed from their holders and replaced with the lamp extractor by applying slight pressure followed by a slight left-hand twist. In the case of 'Lp1' remove first the cap of the switch by turning to the right and pulling at the same time and in that of 'Lp2' the red cover lens.

3.6. Replacing the Fuse

The spare fuse links are also accommodated in the spare parts bag.

The fuse is located besides the power connector and can be easily replaced after screwing off the fuse holder cap. The 0.63-A fuse is provided for voltages between 99 and 132 V and the 0.315-A fuse for voltages between 198 and 264 V.

4. FAULT LOCATION - FAULT ELIMINATION

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4.7.11.	3.1-kHz Coil Filter -D5139-	4-61
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4.1. General Notes

When connecting an exposed chassis to the mains observe the related safety regulations (e.g. in Germany those of the VDE (Association of German Electrical Engineers).

Entrust the fault locating and eliminating work to skilled personnel only. If the type of fault observed is mentioned in the fault location table, a procedure following the information given there will often shorten the fault locating operation considerably.

The main source of information for fault location are fault location plans No. 1 to 8 and the fault location table, and furthermore the corresponding wiring and circuit diagrams of the instrument and the subassemblies. The fault location table indicates the fault location plans and sections of the Fault Elimination part to be referred to in each case. By reference to the circuit diagrams the supply voltages (collector, base, emitter voltages in the case of transistors as well as dc voltages for relays and Zener diodes) are to be measured and compared with the values specified in the circuit diagram.

Unless stated otherwise, ac voltages are to be measured with the RF Multizet meter and dc voltages with the µA-Multizet meter. If a component part that has been identified as being the source of trouble is replaced by another one, a correction of the frequency response, the symmetry of the modulator characteristic, the oscillator frequency or the gain may possibly be required.

When, in a fault locating operation, several transistors or diodes are removed, ensure that, after the check, they are positioned at the same places in the subassembly provided they are in a good operating condition.

Note: If the fault encountered is suspected in filters or oscillators, never change the setting of coil cores but check the terminals, soldered points etc. If a fault cannot be located clearly in a subassembly by reference to the Fault

Elimination part, or if the means required for fault elimination are not available, the faulty subassembly can be exchanged without loss of time (order a replacement subassembly from the works).

4.2. Film Drive, Exchanging the Scale Film

The instruction to exchanging the scale film can be found after section 4.7.16 of the Fault Elimination part.

4.3. Fault Location on the Deenergized Level Meter

If a fault has made itself felt when energizing the equipment unit, first check for a possibly committed operating error. For instance, no open-circuited cable may be connected to jack 'Bu6'. If the equipment unit has failed entirely, check power cable and mains fuse. In addition, a visual inspection of the equipment must be carried out. For this purpose, remove the cover plates of the equipment unit and check the plug-in subassemblies for firm seat. For checking the cabling, swing up the subassembly chassis (see Maintenance part, section 3.).

4.4. Fault Location on the Energized Level Meter

4.4.1. Measuring Instruments and Auxiliary Devices Required

4.4.1.1. For Fault Location

DC multimeter $Z_i \geq 50$ kΩ/V, e.g. Siemens-µA-Multizet meter (M-List No. 231252)

Multi-range RF diodes or electron-tube voltmeter, e.g. Siemens-RF-Multizet meter (M-List No. 231314)

Cathode-ray oscilloscope, e.g. Siemens wideband oscilloscope, Oszillar M 214 with probe divider 10:1

100-MHz frequency counter (absolute error $\frac{\Delta f}{f} \leq \pm 5 \times 10^{-8}$)

Wideband level meter D353 with capacitive probe divider (a = 20 dB)

Selective level meter D335 with capacitive probe divider (a = 20 dB)

Level oscillator, Z = 75 Ω, e.g. Siemens W2021+G2021
Adapter S45035-F263-A701

4.4.1.2. For Fault Elimination

1 selective level meter D2006
1 level oscillator W2006
1 level meter for up to 50 MHz, e.g. U415
1 level generator W2021
1 level receiver D2021
2 frequency generators G2021
1 level meter D335
1 level oscillator W518
1 level meter D354
1 level oscillator W231
1 wideband level meter D353
1 level oscillator W38
1 level oscillator W56
1 superheterodyne receiver U420
1 scale-spread device B977
1 capacitive probe divider (a=20 dB)

1 oscilloscope with probe divider 10:1 and sampling slide-in unit, e.g. Siemens Oszillar M 214

1 frequency counter up to 100 MHz, $\frac{\Delta f}{f} \leqq 5 \times 10^{-8}$ absolute error

1 precision attenuator D120
1 reflectometer bridge R273
1 digital voltmeter
2 reconnectable low-pass filters (Z=75Ω, for up to 20 MHz)
1 ohmmeter 0.01 to 200Ω
1 RF-Multizet meter
1 µA-Multizet meter (Ri ≧ 50 kΩ/V)
1 inductance bridge R 114
1 termination of 75Ω
1 termination of 600Ω
1 adapter S45035-F263-A701
1 heat-cycling chamber for up to +60 °C
2 dc power supplies, 16 V regulated

4.5. Fault Location Table

The fault location table indicates the fault location plans and the sections of the Fault Elimination part according to which the fault can be localized and eliminated.

	Type of Fault	Fault Location and Elimination
4.5.1.	The power supply of the subassemblies has failed	According to section 4.6.1. (fault location plan No. 1)
4.5.2.	Calibration cannot be carried out	According to section 4.6.2. (fault location plan No. 2), section 4.6.4. (fault location plan No. 4), section 4.6.7. (fault location plan No. 7) and section 4.6.8. (fault location plan No. 8)
4.5.3.	Calibrating level is not stable	According to section 4.6.2. (fault location plan No. 2), section 4.6.4. (fault location plan No. 4) and section 4.6.8. (fault location plan No. 8)
4.5.4.	Calibration is possible only when detuning the calibrating frequency by more than 3 kHz	According to section 4.6.2. (fault location plan No. 2) and section 4.6.4. (fault location plan No. 4)

	Type of Fault	Fault Location and Elimination
4.5.5.	No calibration possible because the gain is either too high or too low (insufficient control range of P1)	According to section 4.6.7. (fault location plan No. 7), section 4.6.8. (fault location plan No. 8) and section 4.7.14.
4.5.6.	Calibration is not possible when the 80-Hz filter is in circuit but possible in the case of the 3.1-kHz filter	According to section 4.7.10.
4.5.7.	Calibration is not possible when the 3.1-kHz filter is in circuit but possible in the case of the 80-Hz filter	According to section 4.7.11.
4.5.8.	Change of the indication by up to 0.4 dB upon switching the bandwidth from 80 Hz to 3.1 kHz	Adjust the gain in the filters -D5138- and -D5139-
4.5.9.	Change of the indication exceeds 0.4 dB upon switching the bandwidth from 80 Hz to 3.1 kHz	According to section 4.7.10. and section 4.7.11.
4.5.10.	Calibration can be carried out but not the measurement	Check according to section 4.7.16.
4.5.11.	No or incorrect instrument indication	Check the instrument according to section 4.6.8. (fault location plan No. 8.)

	Type of Fault	Fault Location and Elimination
4.5.12.	Unstable indication on the instrument	According to section 4.6.2. (fault location plan No. 2), section 4.6.4. (fault location plan No. 4), section 4.6.7. (fault location plan No. 7) and section 4.6.8. (fault location plan No. 8).
4.5.13.	Input and IF divider interrupts or divides incorrectly	According to section 4.7.16
4.5.14.	Excessive frequency response f_1	According to sections 4.7.1., 4.7.7. and 4.7.16.
4.5.15.	Excessive frequency response f_2	According to sections 4.7.4., 4.7.5., 4.7.7. and 4.7.8.
4.5.16.	Deviation between scale f_1 and frequency f_1 (in the lock-in mode) exceeds 100 Hz	According to section 4.6.2. (fault location plan No. 2) and section 4.6.1.2. (fault location plan No. 1).
4.5.17.	Deviation between scale f_1 and frequency f_1 (without lock-in) exceeds 10kHz	According to section 4.6.2. (fault location plan No. 2)
4.5.18.	Lock-in action f_1 fails to function	According to section 4.6.1.2. (fault location plan No. 1) and 4.6.2. (fault location plan No.2)
4.5.19.	No signal at jack 'Bu4' (f_1 in 'synchro-tuning' mode)	According to section 4.6.1.2. (fault location plan No. 1) and 4.6.2. (fault location plan No. 2)
4.5.20.	Too narrow locking-in and holding range of f_1	According to section 4.6.3. (fault location plan No. 3)
4.5.21.	Deviation between scale f_2 and frequency f_2 at jack 'Bu7' exceeds 100 Hz	According to section 4.6.5. (fault location plan No. 5)

	Type of Fault	Fault Location and Fault Elimination
4.5.22.	Deviation between scale f_2 and frequency (on modulator 2 -D5136-) exceeds 100 Hz	According to section 4.6.6. (fault location plan No. 6)
4.5.23.	Fault lamp for f_2, 'Lp2' lights	According to section 4.6.6. (fault location plan No. 6)
4.5.24.	No signal at jack 'Bu7' (f_2 in 'synchro-tuning' mode)	According to section 4.7.4.
4.5.25.	When the input level is present, no or incorrect voltage (across 600Ω) is measured at jack 'Bu6'	According to section 4.6.7. (fault location plan No. 7)
4.5.26.	When the input signal is present no or incorrect voltage (across 600Ω) is measured at 'Bu5'	According to section 4.6.8.4. (fault location plan No. 8)
4.5.27.	The transfer from lower to upper sideband using 'S4' cannot be carried out	According to section 4.6.8.4. (fault location plan No. 8)
4.5.28.	No or incorrect voltage at 'Bu10'	According to section 4.6.8.2. (fault location plan No. 8)
4.5.29.	Calibration of the probe head cannot be carried out	According to section 4.6.8.6. (fault location plan No. 8)
4.5.30.	No supply voltage of the probe head	According to section 4.6.1. (fault location plan No. 1)
4.5.31.	Residual distortion exceeds the value specified in the data bulletin	According to section 4.7.7.

	Type of Fault	Fault Location and Elimination
4.5.32.	Image frequency rejection and IF feed-through attenuation are lower than the values specified in the data bulletin	According to section 4.7.7., 4.7.8. and 4.7.9.
4.5.33.	Defective scale films	According to section 4.2.

4.6. Fault Location Plans

The equipment is composed of easy-to-exchange, plug-in subassemblies. Even with the wide variety of individual subassemblies, fault location can be carried out without much effort since the input and output signals of each satisfactorily operating subassembly have well-defined and often equal level values. For instance, all carrier voltages are passed to the converters with a 0-dBm power level into 75Ω (this corresponds to a voltage level of -9.04 dB or a voltage of 274 mV).

In this manner inadmissible deviations from the nominal values can be rapidly detected and defective subassemblies exchanged accordingly without loss of time.

By reference to the fault location plans the defective subassembly or trouble in the equipment cabling can be found out.

4.6.1. Fault Location Plan No. 1

4.6.1.1. After removing the right-hand lateral cover plate, the power supply -D5143- with power supply board -D5147- become visible. Check, on the power supply board, the dc supply voltages for the subassemblies by reference to circuit and wiring diagram.

Power supply board, pin	Voltage against chassis ground
5	5.5 V ± 0.05 V
8	16 V ± 0.1 V

If the voltage values on the power supply board are correct, check the dc supply voltages directly at the terminals of the subassemblies by reference to the circuit and wiring diagrams -D2006-; in the case of incorrect values or absent voltages check the power supply -D5143- by reference to the Fault Elimination part, section 4.7.15.

4.6.1.2. At the wipers of the potentiometers 'P2' and 'P3' the dc voltages are to be measured and, if necessary, adjusted with the respective potentiometer.

Wiper of potentiometer 'P2' V = +6 V ± 0.05 V dc
Wiper of potentiometer 'P3' V = +5.6 V ± 0.05 V dc

If these voltages cannot be set, then check the wiring to the potentiometers.

4.6.2. Fault Location Plan No. 2

Connect the subassembly -D5135- to the level meter by means of an adapter.

4.6.2.1. Voltage and frequency are to be measured at pin 20/21 of the subassembly:

Nominal values: V_{ac} = 235 mV ± 50 mV in the case of $f_{osc} = f_1$ + 24 MHz ± Δ f,

whereby the frequency f_{osc} = 24 MHz corresponds to the setting 'f_1 = 0 MHz, without lock-in' on the f_1 scale and the frequency deviation Δ f should not exceed 10 kHz.

The same frequency values, but with V_{ac} = 275 mV ± 50 mV should also be measured at jack 'Bu4' of -D2006- when the former has been terminated into 75 Ω.

In the case of deviations of the measured values from the nominal values, check the oscillator f_1 -D5122- by reference to the Fault Elimination part, section 4.7.1.

4.6.2.2. Voltage and frequency are also to be measured at pins 20/21 but with the oscillator f_1 in the lock-in mode:

Nominal values: V_{ac} = 235 mV ± 50 mV in the case of $f_{osc} = f_1$ + 24 MHz ± Δ f with Δ f =100 Hz

The same frequency values but with V_{ac} = 275 mV ± 50 mV should also be measured at jack 'Bu4' of -D2006- (terminated into 75 Ω).

If the values specified are not reached, then proceed according to fault location plan No. 3, section 4.6.3.

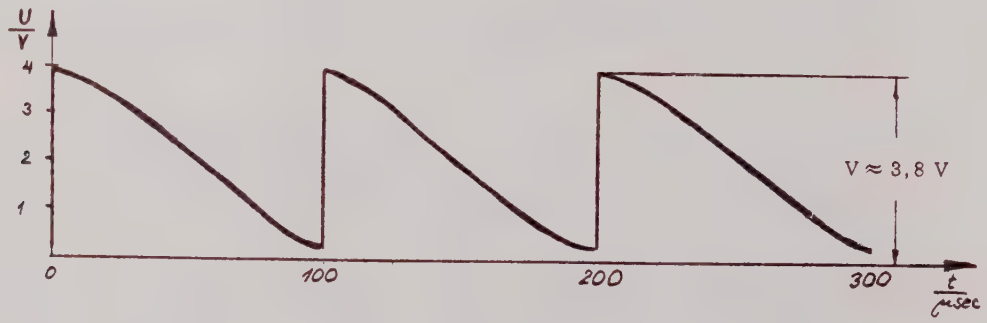
4.6.3. Fault Location Plan No. 3

Connect subassembly -D5126- to level meter -D2006- via an adapter and set oscillator f_1 (-D5122-), in the lock-in mode to 16 MHz. The relay indicating the f_1 lock-in condition by an audible click must operate and the f_1 lock-in lamp light up. In this case, the input and output voltages of subassembly -D5126- have the following values:

4.6.3.1. At pin 9/10: V_{ac} = 210 mV ± 50 mV f = 40 MHz ± 100 Hz

4.6.3.2. At pin 1/2: V_{ac} = 235 mV ± 50 mV f = 40 MHz ± 100 Hz

4.6.3.3. At pin 20/21:



4.6.3.4. At pin 14/15: approx. dc voltage: 3.5 to 6.5 V within the lock-in range.

4.6.3.5. If the relay operates with an audible click, all nominal values (4.6.3.1. to 4.6.3.4.) are met, however, if the lamp 'Lp1' fails to light, first exchange it. If the new lamp also fails to light, then check the wiring to the lamp and relay A2 by reference to the circuit and wiring diagrams -D2006-.

4.6.3.6. If neither relay A2 operates nor lamp 'Lp1' lights but the nominal values 4.6.3.1. to 4.6.3.4. are met then check subassembly -D5126- according to section 4.7.3. of the Fault Elimination part.

4.6.3.7. If the nominal values 4.6.3.1. to 4.6.3.4. are not met, then check the subassembly -D5122- by reference to section 4.7.1., the subassembly -D5126- by reference to section 4.7.3., the subassembly -D5125- by reference to section 4.7.2. of the Fault Elimination part.
Slight deviations from the nominal frequency (4.6.3.1. and 4.6.3.2.) can be corrected with the trimmer C4 in -D5125-.

4.6.4. Fault Location Plan No. 4

Connect subassembly -D5136- to level meter -D2006- via an adapter.
Voltage and frequency are to be measured at pin 20/21 of the subassembly:

Nominal values: V_{ac} = 275 mV $\pm$ 50 mV
f = 21.6 to 21.5 MHz $\pm \Delta f$ with $\Delta f \leqq 100$ Hz

Here, f = 21.6 MHz corresponds to the frequency f_2=0 kHz set on the f_2 scale and f = 21.5 MHz to the frequency f_2 = 100 kHz. If these values are not met, proceed according to fault location plan No. 5, section 4.6.5. and fault location plan No.6, section 4.6.6.

4.6.5. Fault Location Plan No. 5

Connect subassembly -D5133- to level meter -D2006- via an adapter.

4.6.5.1. In the case of a frequency of f_2 = 0 kHz set on the film scale f_2 and a frequency of f = 500 kHz $\pm$ 100 Hz, an ac voltage of approx. 1.1 V must be measured at pins 30/31 of subassembly -D5133-.

4.6.5.2. With the same setting as above, the voltage and frequency are to be measured at jack 'Bu7' terminated into 75Ω, of -D2006-:

Nominal values: V_{ac} = 275 mV ± 70 mV
f = 500 kHz ± 100 Hz

If these values are not reached, check the oscillator f_2 by reference to the section 4.7.4. of the Fault Elimination part.

4.6.5.3. If the values specified are met, voltage and frequency are to be measured at pins 15/16 of subassembly -D5133-:

Nominal values: V_{ac} = 120 mV ± 20 mV
f = 500 kHz ± 100 Hz

with the same setting of oscillator f_2 as under 4.6.5.1. If the deviations from the nominal values exceed those specified, then check the subassemblies -D5132- and -D5133- by reference to sections 4.7.5. and 4.7.6. of the Fault Elimination part.

4.6.5.4. If the nominal values of 4.6.5.2. are met, a dc voltage of approx. 5.5 V in the case of f_2 = 0 kHz and 2.7 V in the case of f_2 = 100 kHz must appear at pins 3/4 with respect to 5/6.
If these values are not measured, check the subassembly -D5133- by reference to section 4.7.6. of the Fault Elimination part.

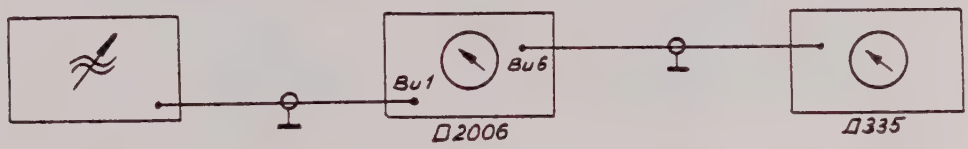
4.6.6. Fault Location Plan No. 6

Connect subassembly -D5132- to level meter -D2006- by means of an adapter.
In the case of a frequency setting of f_2 = 0 kHz (on the f_2-film scale) an ac voltage of 275 mV ± 50 mV must be measured at pin 26/27 of subassembly -D5132- at f = 21.6 MHz ± Δf with Δf = 100 Hz.

Frequency deviations exceeding $\Delta f = \pm 100$ Hz can be corrected with the trimmer 'C3'. If the control range of C3 is insufficient, then proceed according to section 4.6.5.

4.6.7. Fault Location Plan No. 7

Connect a level oscillator and a level meter to level meter -D2006- according to the following circuit diagram:



~ = 0 dB (0 dBm)		p = 0 dB
Z = 75 Ω	f = 100kHz	f = 100kHz, Z = 600 Ω
f = 100 kHz	bandwidth=3.1kHz	bandwidth = 3.1 kHz

Depending on the model of D2006 apply 0 dB respectively, or 0 dBm respectively, from the level oscillator.

Before carrying out the measurement, calibrate the level meter D335 with the level oscillator.

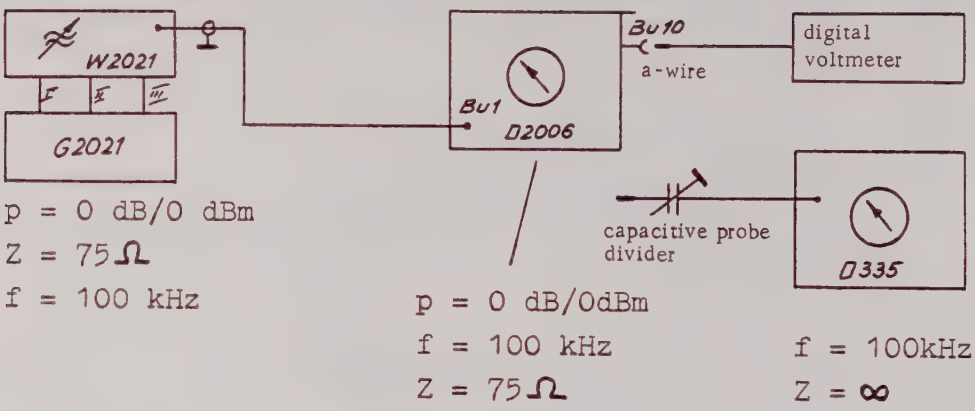
First tune -D2006- (without -D335- being connected to Bu6) to the transmitting frequency. Thereupon, set the sensitivity switch 'S1' of -D2006- to the position 'dynamic output' (red point) and connect -D335- to Bu6. This disables the meter circuit of the -D2006-. Now, tune the -D335- to the intermediate frequency of the -D2006- (100 kHz). A level of 0 dB $\pm$ 0.05 dB must be indicated on the -D335-.

Repeat the measurement with the 80-Hz bandwidth of -D2006-.

If the tolerance of 0.05 dB is exceeded, a setting to the nominal value can be made using the potentiometer 'P4' (behind the front panel, next to the jack 'Bu6'). If the control range of 'P4' is insufficient, check the subassemblies -D2052-, -D5135-, -D5136-, -D5137-, -D5138- and -D5139- in succession by reference to sections 4.7.7. to 4.7.11. and 4.7.16. of the Fault Elimination part.

4.6.8. Fault Location Plan No. 8

Measuring setup:



Set the capacitive probe divider to a = 20 dB. For this purpose, terminate the level generator (f = 100 kHz with lock-in) into 75 Ω and connect the capacitive probe divider to this 75-Ω termination. Set the probe divider to a = 20 dB via the level meter -D335- calibrated previously with the level generator -W2021-.

4.6.8.1. Connect the output section of the level meter, i.e. the board -D5142- into circuit by means of an adapter and connect the capacitive probe divider to pins 7/8 of the board against chassis ground (pins 11/12). First align the -D2006- for maximum indication on the -D335- then align -D335- proper for a maximum value. A level of approx. -11 dB (+9 dB at pins 7/8 of the subassembly) must be indicated on -D335-. If this value is not measured but the nominal value of fault location plan 7, section 4.6.7. has been reached, check the subassemblies -D5140-, -D2052- and -D5141- by reference to sections 4.7.12., 4.7.16 and 4.7.13 of the Fault Elimination part.

4.6.8.2. If a level of approx. -11 dB is indicated on the -D335-, adjust this reading with the level oscillator accurately to p = -11 dB.
The pointer of the instrument of the -D2006- must now be accurately at the 0-dB mark, on the digital voltmeter a voltage of 194 mV must be indicated.
If the settings and values are not correct, the indicator of the instrument can be set to the 0-dB mark with the potentiometer 'R8', and the voltage at 'Bu10' set to 194 mV with 'R9'. (Note: The two aligning operations influence each other and must therefore be repeated several times).
If the control ranges of 'R8' and 'R9' do not suffice, check subassembly -D5142- according to section 4.7.14. of the Fault Elimination.

4.6.8.3. When a level of p = +9 dB is present at pins 7/8 of the subassembly, then a level of +4 dB must be present at pins 9/10. Should this not be the case, check subassembly -D5141- according to section 4.7.13.

4.6.8.4. The level oscillator remains connected to the level meter -D2006-, as in 4.6.8.2.. With a frequency counter, measure the frequency of -D2006- at jack 'Bu6' and set control f_2 for 100 kHz $\pm$ 5 Hz (sensitivity switch 'S1' should be on the red dot). Thereafter set the switch 'S4' of -D2006- to the left hand stop (lower sideband) and measure the frequency at jack 'Bu5'.

Nominal value: f_{low}=1.85 kHz $\pm$ 20 Hz
(can be set at IF = 100 kHz $\pm$ 5 Hz with Ü1 and C11 on board -D5142-).
When switching to the upper sideband (with 'S4') the frequency f_{high}=1.85 kHz $\pm$ 20 Hz must also be indicated on the counter (can be set at IF = 100 kHz $\pm$ 5 Hz with C1 behind the front panel).

Both the lower and the upper sidebands should have an output level, measured with a level meter (Z = 600Ω, f = 100 kHz, p = 0 dB, tuned to the IF of the -D2006-) of p = 0 dB ± 1 dB.

If these values are not achieved, check subassembly -D5142- according to section 4.7.14.

4.6.8.5. The level oscillator remains further connected to the -D2006-. A level of +4 dB appears at pins 9/10 as in 4.6.8.3.
The level meter -D335- (high-impedance setting) is now connected via a capacitive probe-type divider (a = 20dB, calibrated) to pins 17/18 of subassembly -D5142-. The reading on the level meter must appear approx. at -70 dB (accurate adjustment according to section 3.4.).

4.6.8.6. When connecting the capacitive probe-type divider to pins 20/21, a level of approx. 80 dB must be indicated on the level meter. If the values of paras. 4.6.8.5. and 4.6.8.6. are not achieved, check subassembly -D5142- according to section 4.7.14. of the Fault Elimination.

4.7. Fault Elimination

Notes on Fault Elimination

If a subassembly has been found defective by a fault location plan, first make a visual examination of it. Overloaded resistors and coils can often be recognized by their change of color (scorched). Before replacing such parts always first clearly ascertain the cause of the fault and remedy it, e.g. check a following transistor, diode or capacitor for a possibly present short circuit.

If a fault is suspected or detected in a filter, do not move coil cores during a visual examination. For fault elimination connect the plug-in subassemblies via an adapter to the level generator as in fault location. The oscillators f_1 and f_2 remain built-in and connected in the equipment unit.

4.7.1. Oscillator f_1 -D5122-

Oscillator f_1 is composed of oscillator 1 (-D5123-), buffer amplifier 1 (-D5124-) and filter plate (-D5127-). A frequency f_1 = 1 MHz set on the frequency scale f_1 corresponds to an oscillator frequency of f_{osc} = 24 MHz, and f_1 = 17 MHz to f_{osc} = 41 MHz.

$$f_{osc} = f_1 + 24 \text{ MHz} \pm \Delta f$$

4.7.1.1. Measuring Instruments Required

1 oscilloscope with probe-type divider, e.g. M214
1 frequency counter for up to 50 MHz
1 digital voltmeter
1 RF Multizet meter
1 µA-Multizet meter

4.7.1.2. Accessories

1 75-Ω termination, 1.6/5.6

1 heat cycling chamber for up to +60 °C

4.7.1.3. Preparatory Work

In order to reach all the measuring points in and on the oscillator, remove the cover plates from the equipment unit and swing up the subassembly chassis (section 3., maintenance). The cover plate of the oscillator (bottom side) must also be screwed off.

4.7.1.4. Note

Oscillator -D5122- is TC-compensated. Never change the setting of the TC trimmer 'C15' in the oscillator. If, however, a frequency-determining component has to be replaced for fault elimination, then a new TC alignment will be necessary, and a check of the frequency scale. If the film scale no longer corresponds to the output frequency ($\Delta f > 10$ kHz), adjust the film scale by reference to section 3.2., or if this does not suffice redraw it (preferably return the oscillator to the factory).

4.7.1.5. Input Current

Set switch 'S2' of -D2006- to 'lock-in off', separate the supply voltage V_{dc} = 16 V ± 0.1 V from terminal 'c' of the ceramic solder terminal strip and reconnect it via a µA-Multizet meter (100-mA range). The current indicated on the µA-Multizet meter should have the value

$$Io = 72 \text{ mA} \pm 10 \text{ mA}$$

(Io is composed of: Io from -D5123- 30 mA ± 5 mA,
Io from -D5124- 42 mA ± 5 mA)

4.7.1.6. DC Voltages

Check the following dc voltages against chassis ground with a /uA-Multizet meter:

Voltage at C24 and C36 V = 16 V ± 0.1 V dc

Volts	Ts1	Ts2	Ts3	Ts4
V_K	10.5-12.5	15.0-16.0	15.5-16.0	15.5-16.0
V_B	2.4-2.8	6.0- 8.0	5.3- 7.3	2.5-3.0
V_E	1.5- 2.0 (1)	5.3- 7.3 (1)	4.6- 6.6 (1)	2.5 (1)

Volts	Ts5	Ts6	Ts7	Ts8
V_K	15.0-16.0	13.7-14.7	15.0-16.0	13.7-14.7
V_B	6.5-8.5	4.6- 6.6	6.5- 8.5	4.6- 6.6
V_E	5.8-7.8	3.9- 5.9	5.8- 7.8	3.9- 5.9

(1) These values apply for a short circuit of coil 'L1'

4.7.1.7. Varactor Bias

At terminal 'a' and 'b' of the ceramic solder terminal, the same dc voltage must appear, measured with a digital voltmeter, in the position of switch 'S2' at 'lock-in off'.

V = 4.5 V ± 0.05 V dc (can be corrected with potentiometer R81)

4.7.1.8. Output Voltage

Continue to operate the oscillator in 'free-running'. Terminate jack 'Bu4' into a 75-Ω impedance. A voltage of V = 280 mV ± 20 mV ac (to be set with potentiometer R20 in oscillator -D5123-, measured with a RF Multizet meter) should appear at pin 2 of the buffer amplifier when f_{osc} = 24 MHz (0 MHz on the film scale), and a voltage of V = 280 mV ± 50 mV ac at pin 6 of the buffer amplifier -D5124-.

4.7.1.9. Frequency Response

Operate the oscillator as in 4.7.1.8. With an increase of the frequency to f_{osc} = 41 MHz (17 MHz on the film scale), the output level may change maximally by ΔV = 50 mV ac.

4.7.1.10. Waveform

Examine the waveform of the output voltages with the oscilloscope.

A pure undistorted sine wave must appear at pin 2 of the oscillator subassembly -D5123-, and at pins 3 and 6 of the buffer amplifier -D5124-.

4.7.1.11. Frequency Range

With a frequency counter (at jack 4) check the frequency of the oscillator at the left-hand and right-hand stops of the film drive:

Nominal values: $f_{low} \leqq 23.8$ MHz

$f_{high} \geqq 41.1$ MHz

4.7.1.12. TC Alignment

This aligning operation is necessary when frequency-determining components have been replaced in oscillator -D5123-. Remove the oscillator subassembly from -D2006-, and replace the cover plate of the oscillator with another (having a hole over TC trimmer C15). Adjust the TC trimmer to accurately mid-position.

Connect oscillator f_1 into 75 Ω to jack 'Bu11', at terminal 'c' of the ceramic solder terminal strip apply a dc voltage of V = 16 V ± 0.1 V dc. Connect terminals 'a' and 'b' of the solder terminal strip (dc voltage measured at 'a' and 'b' with digital voltmeter and set to V dc = 4.5 V ± 50 mV with R81 in -D5127-).

Set the frequency of the oscillator at room temperature to approx. 40 MHz. Note this value. Then, without changing the frequency and without touching coupling and film drive, heat the energized subassembly with a connected supply voltage and a frequency counter in a heat cycling chamber up to +60 °C. After two hours at +60 °C measure the frequency of the oscillator again. If the frequency increment between the cold and the hot state of the oscillator exceeds 8 kHz, then, with the TC trimmer C15, set the output frequency of the oscillator heated up to +60 °C with an aligning tool also heated to +60 °C to the value measured at room temperature. Remove the connection between 'a' to 'b' of the solder terminal strip.

4.7.2. Oscillator - Divider - Phase Modulator -D5125-

4.7.2.1. Measuring Instruments Required

1 oscilloscope with probe divider, e.g. M214
1 frequency counter with $\frac{\Delta f}{f} \leq 5 \times 10^{-8}$
1 wideband level meter with capacitive probe divider (a = 20 dB)
1 µA-Multizet meter
1 RF Multizet meter

4.7.2.2. Input Current

The input current of the subassembly is to be with

5.5-V power supply I_1 = 115 mA ± 15 mA,
16-V power supply I_2 = 45 mA ± 5 mA.

4.7.2.3. DC Voltages

Check the following dc voltages with a µA-Multizet meter against chassis ground:

voltage at pins 26/27 5.5 V ± 0.05 V (1)
voltage at pins 28/29 6 V ± 0.05 V (2)

(1) effect a setting with potentiometer R16 on the power supply board -D5147-

(2) effect a setting with potentiometer P 2 (behind the front panel)

Volts	Ts1	Ts2	Ts3	Ts4
V_K	13.0-14.0	5.3-5.5	5.2-5.5	15.0-16.0
V_B	1.5- 2.2	-	-	-
V_E	0.9- 1.5	0.9- 1.5	-	-

Volts	Ts5	Ts6	Ts7	Ts8
V_K	15.0-16.0	4.0-5.0	7.4-9.8	14.0-15.0
V_B	-	1.6-2.1	2.0-2.5	7.4-9.8
V_E	-	1.0-1.4	1.5-2.0	7.0-9.0

Volts	Ts9	Ts10	Ts11	Ts12
V_K	15.6-16.2	13.0-14.2	4.9-5.5	2.1-2.7
V_B	7.0- 8.0	5.6- 6.6	1.7-2.3	4.2-4.8
V_E	6.3- 7.3	4.9- 5.9	1.1-1.7	5.0- 5.4

Volts	Ts13
V_K	2.1 - 2.7
V_B	-
V_E	

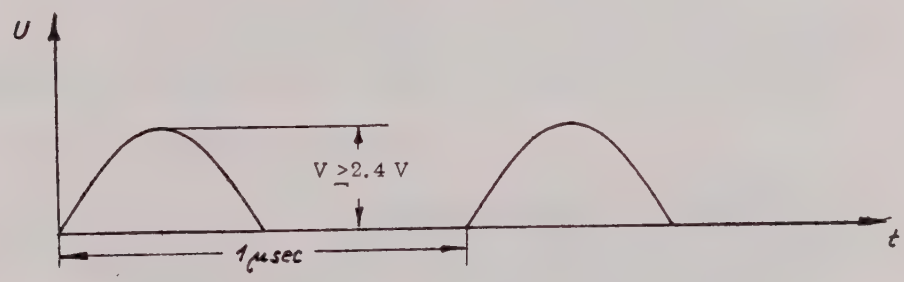
4.7.2.4. Aligning the Oscillator and Checking the Frequency

Connect a µA-Multizet meter (300-mV range) to terminal 1 of the transformer Ü1. With trimmer C4 in mid-position align the core of Ü1 for maximum reading of the µA-Multizet meter (90 mV $\geqq V_{max} \geqq$ 40 mV). Remove the µA-Multizet meter.

With the oscilloscope + 10:1 probe-type divider measure the voltage at R7:

Nominal value: $7\ V_{p-p} \leqq V_{p-p} \leqq 9\ V_{p-p}$

Measure the voltage of Ts2 at the emitter with the oscilloscope (sine alternations):



If $V_S < 2.4$ V, diode Gr2 (IF 6.8) must be checked for sharpness of cutoff and narrowed-down tolerances. Remove the oscilloscope after the measurement.

Setting the 1-MHz Oscillator

The wideband level meter is connected via the capacitive probe-type divider to R8 of the subassembly; apply the frequency counter to the output of the wideband level meter.

Now set the oscillator frequency with trimmer C4.

Nominal value: $f = 1.000{,}000\ \text{MHz} \pm 1\ \text{Hz}$

(Caution: The oscillator must be at normal operating temperature, see also 3.2.)

Checking the Regulating Range

The level meter and the frequency counter remain connected as before.

When changing the voltage at pins 28/29 from 6 V to 2 V, the frequency should decrease to

$$f \leq 999{,}990\ \text{Hz},$$

when changing the voltage from 6 V up to 14 V, the frequency should increase to

$$f \geq 1000{,}010\ \text{Hz}.$$

After these measurements, the voltage must be set to 6 V again (digital voltmeter).

Checking the 100-kHz Divider

Now connect the capacitive divider to terminal 1 of the JC1 of the subassembly (caution: do not cause any short circuits on the JC in this operation).
The frequency measured with the frequency counter should be

$$f = 100{,}000\ \text{Hz} \pm 1\ \text{Hz}$$

Checking the 10-kHz Divider

Connect the capacitive divider to terminal 12 of the JC2 of the subassembly against chassis ground.
The frequency should be

$$f = 10{,}000\ \text{Hz} \pm 1\ \text{Hz}$$

4.7.2.5. Setting the Pulse Voltage

Connect the oscilloscope to R15, set the pulse voltage with R12 to

$$V_s = 2.9\ \text{V} \pm 0.1\ \text{V}$$

The waveform of this pulse voltage and the other voltage wave forms are shown in the circuit diagram of the sub-assembly.

4.7.2.6. Checking the Divider

Check the divider 10:1 at R57 of the subassembly with the frequency counter.

-D2006- f_1 with lock-in	-D5125- pins 1/2	-D5125- R57
0 MHz	24 MHz	2.4 MHz
17 MHz	41 MHz	4.1 MHz

4.7.2.7. Checking the Phase Modulator

Connect the oscilloscope to the base of Ts6 via the 10:1 probe divider and check the waveform and the value of the indicated voltage:

Nominal value:

$$V_{p-p} \geqq 0.20\ V$$

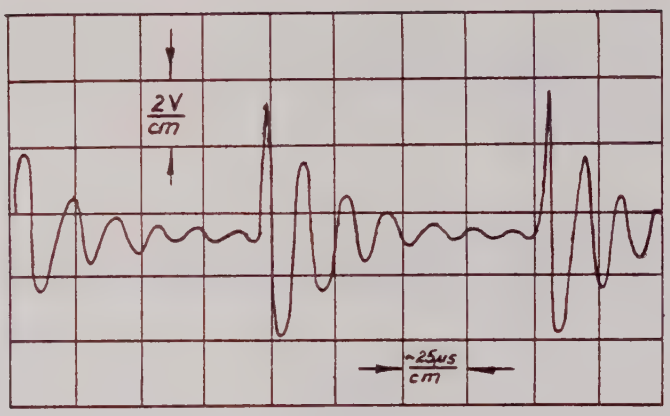
If this value is not met, check item 3.7.2.5. again.

4.7.2.8. Checking the Amplifier

Connect the oscilloscope to R34 via the probe divider.

The peak voltage of the maximum amplitude should amount to

$$V_{p-p} \geqq 6\ V$$



4.7.2.9. Checking the Rectification

Connect the oscilloscope via the probe divider to pins 18/19 and measure the sawtooth voltage present there.

Nominal value:

$$V_{p-p} = 3.8\ V_{p-p} \pm 0.8\ V_{p-p}$$

4.7.3. Filter/Amplifier -D5126-

4.7.3.1. Measuring Equipment Required

1 oscilloscope, e.g. M214
1 RF Multizet meter
1 frequency counter
1 level oscillator, e.g. W231
1 level meter, e.g. D354
1 µA-Multizet meter

4.7.3.2. Input Current

Measure the input current of the subassembly by using a µA-Multizet meter (30 -mA range).

Nominal value: Io = 20 mA ± 3 mA

(subassembly removed from equipment unit, pins 3/4 and 30/31 interconnected, 16 V dc applied to pins 30/31 via µA-Multizet meter).

4.7.3.3. DC Voltages

Check the following dc voltages with a /uA-Multizet meter against chassis ground:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	4.0-5.5	5.0-7.0	12.0-15.0	0.6-1.2
V_B	2.0-3.0	1.1-1.5	5.0- 7.0	1.1-1.7
V_E	1.4-2.2	0.5-1.0	4.4- 6.4	0.4-1.0

Volts	Ts5	Ts6
V_K	14.2-14.8	15.7-16.0
V_B	5.7- 7.7	5.15-7.15
V_E	5.0- 7.0	4.5 -6.5

V at C6 against chassis ground: V_{c6} = 10 V ± 0.2 V
If the voltage at C6 exceeds a tolerance of ± 0.3 V, replace Gr 1 (IF 10).

4.7.3.4. Filter

For this check, subassembly -D5126- remains connected to level meter -D2006- (f = 1 MHz locked-in) with pins 1/2, 3/4, 5-8, 9/10, 11-13, 26/27 and 30/31.

Connect a level oscillator (p = -25 dB, f = 2 kHz ± 40 Hz, $Z_i \approx 0$) to pins 20/21 (chassis ground pins 16-19) via an 1.5-/uF capacitor and a level meter (wideband, high impedance setting) to pins 14/15. The measured level should be

p = -27.7 dB ± 1.5 dB

Following this, connect the level meter to the emitter of Ts3. Measured level: p = + 12 dB ± 3 dB (lock-in lamp does not light). The lock-in lamp must light when the input level at pins 20/21 is reduced to p = -35 dB.

4.7.3.4.1. Aligning the 10-kHz Pole

The level oscillator remains connected to the subassembly as in 4.7.3.4.

(W231: p = 0 dB; f = 10 kHz ± 5 Hz (check with the counter); $Z_i \approx 0$)

Connect level meter D344 (selective, high impedance setting, synchronized with W231) to the collector of Ts1 (against chassis ground). Align L1 of the subassembly to a minimum indication on the level meter.

Nominal value:

$$p < -70 \text{ dB}$$

The measured value of the level meter connected to pins 14/15 (against chassis ground) should be

$$p < -90 \text{ dB}.$$

Aligning the 20-kHz Pole

The level oscillator remains connected to the subassembly, merely the frequency is varied to f = 20 kHz ± 5 Hz.

The level measured with the level meter at the collector of Ts1 and aligned with L2 of the subassembly for a minimum should be

$$p = < -85 \text{ dB}.$$

Repeat the aligning of the 10-kHz pole.

4.7.3.5. Amplifier

Using an RF Multizet meter measure the input voltage at pins 9/10, the output voltage at pins 1/2 of the amplifier at f_1 = 0 MHz and f_1 = 17 MHz:

$$V_{in} = 210 \text{ mV} \pm 20 \text{ mV ac}$$
$$V_{out} = 235 \text{ mV} \pm 20 \text{ mV ac}$$

Check the voltage at pins 1/2 with the oscilloscope.

A pure, undistorted sinusoidal waveform must be displayed.

4.7.4. Oscillator f_2 -D5129-

Oscillator f_2 consists of the subassembly 'oscillator 2' (-D5130-) and 'buffer amplifier 2' (-D5131-). Frequency f_2 = 0 kHz set on the f_2-film scale corresponds to the oscillator frequency f_{osc} = 500 kHz, and frequency f_2= 100 kHz corresponds to the oscillator frequency f_{osc} = 600 kHz, hence

$$f_{osc} = f_2 + 500 \text{ kHz}$$

4.7.4.1. Measuring Instruments Required

1 frequency counter $\frac{\Delta f}{f} \leq 5 \times 10^{-8}$

1 oscilloscope with probe divider, e.g. M214

1 level meter, e.g. D354 (coaxial, high impedance setting, wideband)

1 µA-Multizet meter

4.7.4.2. 1 heat cycling chamber for up to +60 °C

1 75-Ω termination (1.6/5.6)

4.7.4.3. Preparatory Work

In order to reach all the measuring points on and in the oscillator, remove the cover plates from the device and swing back the subassembly chassis (section 3, maintenance). The cover plate on the bottom of the oscillator is also to be unscrewed.

4.7.4.4. Oscillator f_2 is TC-compensated. If a frequency-determining component has to be replaced for fault elimination, the TC alignment must be repeated and the frequency scale checked. If the film scale no longer agrees with the output frequency of the oscillator ($\Delta f > 100$ Hz), adjust the film scale by reference to section 3.3., or if this does not suffice, redraw it (preferably return the oscillator to the factory).

4.7.4.5. Input Current

Separate the supply voltage V = 16 ± 0.1 V dc from the lead-through capacitor C15 and reapply it to C15 via a µA-Multizet meter (30-mA range). The µA-Multizet meter should read

Io = 15 mA ± 3 mA.

(Io is composed of

Io from -D5130- 4 mA ± 1 mA
Io from -D5131- 11 mA ± 2 mA)

4.7.4.6. DC Voltages

Check the following dc voltages with a µA-Multizet meter against chassis ground:

Pin 1 of -D5130- V = 16 ± 0.1 Volts dc
Pins 4/5 of -D5131- V = 16 ± 0.1 Volts dc

Volts	Ts1	Ts2	Ts3
V_K	13.4-17.4	14.1-16.1	14.1-16.1
V_B	2.0- 2.4	10.5-12.0	10.0-12.0
V_E	1.5-2.0	9.5-11.5	9.3-11.3

4.7.4.7. Output Voltages

Insert a 75-Ω termination in jack 'Bu7' of -D2006-. Connect an oscilloscope to pin 2 of oscillator 2 (-D5130-) and measure the output voltage with it.

Nominal value: sine wave of 3 to 4 V_{p-p}

Disconnect the oscilloscope from pin 2.

Unscrew the coaxial cable connecting the equipment unit to jack "Bu12' and connect a level meter (coaxial, high-impedance setting, wideband)instead. Measure the output voltage at f_2 = 50 kHz (that is f_{osc} = 550 kHz at jack 'Bu12').

Nominal value: p = +3 dB ± 1 dB

Connect the level meter to jack 'Bu7' (coaxial, Z = 75Ω, wideband). The output level should have the value

p = -9 dB ± 1 dB

4.7.4.8. Frequency Response

The level meter remains connected to jack 'Bu7'. Referring to the value measured at f_2 = 50 kHz (f_{osc} = 550 kHz), the output voltage may vary by ± 0.25 dB at most.

4.7.4.9. TC Alignment

This aligning operation is necessary when frequency-determining components had to be replaced in oscillator -D5130-. Remove oscillator f_2 from the -D2006-. At room temperature keep oscillator f_2 operating for approx. 1 hour with power applied. The variable capacitor is in mid-position ($f \approx 550$ kHz). Lightly tap the coupling to eliminate possibly present jamming forces.

Frequency f_1 at Temperature t_1

With the frequency counter measure frequency f_1 at room temperature t_1 at jack 7, and note it.

Frequency f_2 at Temperature t_2

After measuring f_1 at t_1, heat 'oscillator f_2', without touching the film drive hence without a frequency change, by approx. 40 °C (hence to the temperature t_1 + 40 ° $\approx$ + 60 °) in a heat cycling chamber, with the power

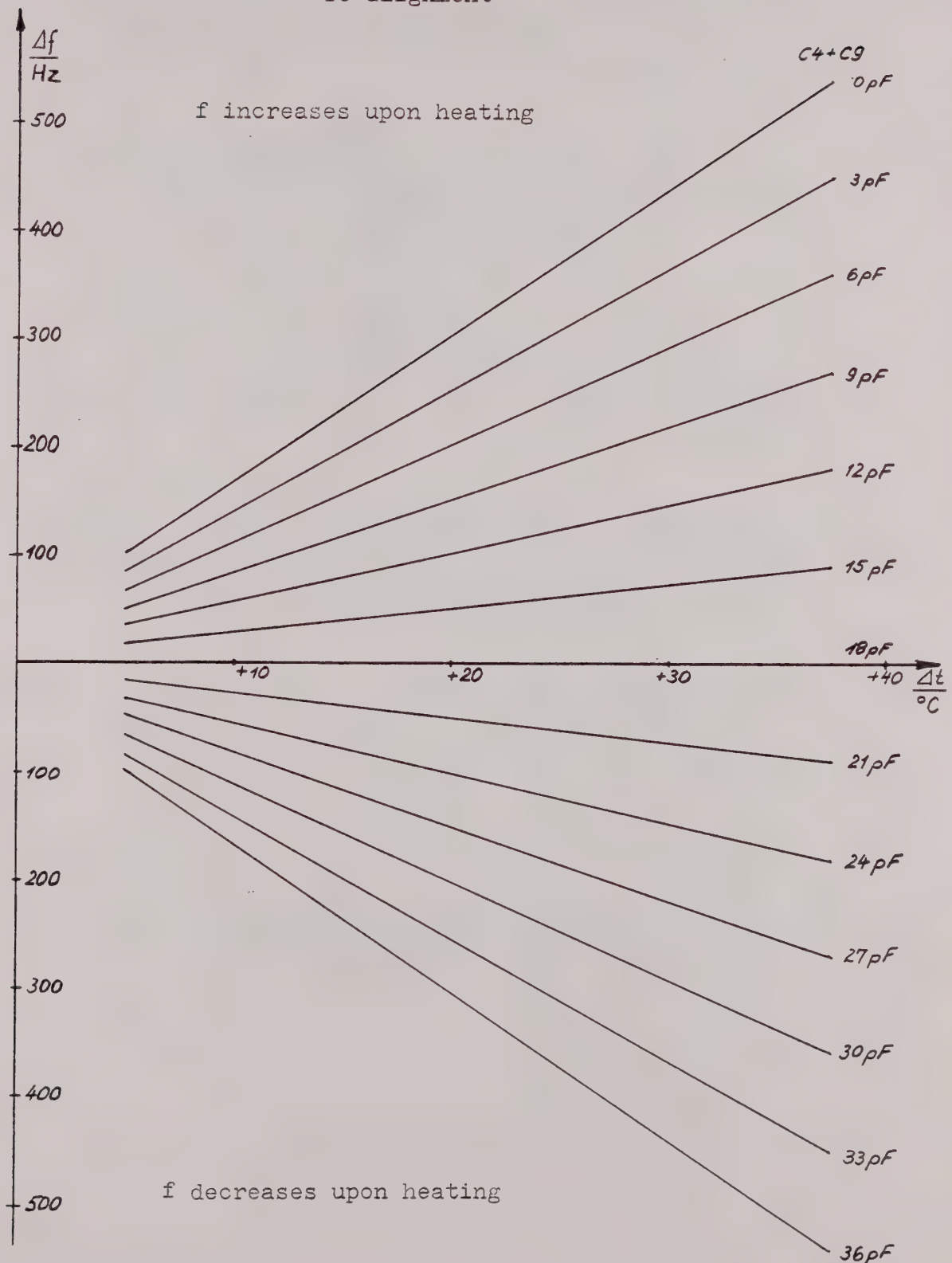
and the counter connected, and run it at this temperature t_2 for approx. 2 hours. Subsequently measure the frequency (f_2) and the temperature (t_2) again.

Calculate the differences between f_2 and f_1 and t_2 and t_1:

$$\Delta f = f_2 - f_1 \quad \text{and} \quad \Delta t = t_2 - t_1$$

If the frequency difference exceeds 60 Hz, the aligning capacitors required (C4 and C9) are determined according to the enclosed table and soldered in the subassembly.

TC alignment



4.7.4.10. Frequency Setting

Power supply and counter remain connected, the film drive is to be set to the right hand stop. Set the nominal frequency with C5.

$$f_{nominal} = 611 \text{ to } 615 \text{ kHz}$$

Turn the film drive to the left hand stop. The frequency displayed then should be

$$f \leq 486 \text{ kHz}$$

Now screw the aluminum plate onto the casting.

Agreement between Scale and Frequency

Check the agreement between scale and frequency at each 10-kHz line.

$$\Delta f \leq 100 \text{ Hz}$$

If the scale no longer agrees with the output frequency, it must be adjusted by reference to section 3.3. or, should this prove insufficient, redrawn (preferably return the oscillator to the works).

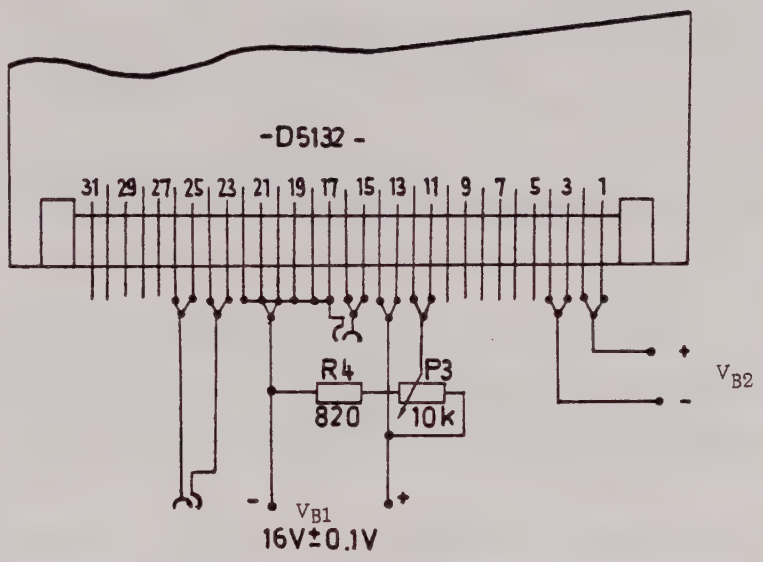
4.7.5. Oscillator/Modulator -D5132-

These subassemblies are not checked via an adapter in the overall equipment but externally.

4.7.5.1. Measuring Instruments Required

1 wideband level meter, e.g. D353
1 capacitive probe divider (a = 20 dB)
1 oscilloscope with sampling slide-in unit, e.g. Siemens-Oszillar M214 with sampling slide-in unit
1 frequency counter
1 digital voltmeter
1 RF-Multizet meter
1 µA-Multizet meter
2 dc power supplies, stabilized, 0 to 16 V

4.7.5.2. Input Current



Apply a dc voltage of V_{B1} = 16 ± 0.1 V to the terminals of V_{B1} (pins 13/14 = positive pole, pins 20/21 = negative pole) via a µA-Multizet meter (100-mA range) and measure the input current of the subassembly:

$$Io = 50 \text{ mA} \pm 5 \text{ mA}$$

4.7.5.3. DC Voltages

With the power supply (V_{B1}) of the subassembly applied, check the following dc voltages with a µA-Multizet meter against chassis ground:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	14.0 to 17.0	14.0-17.0	14.0-16.0	14.0-16.0
V_B	2.5 to 3.5	4.3- 5.3	5.0- 6.0	5.6- 6.8
V_E	2.0 to 3.0	3.4- 4.6	4.2- 5.4	5.0- 6.0

V	Ts5	Ts6	Ts7
V_K	14.0-16.0	8.0 to 10.0	12.5 to 14.5
V_B	6.3 to 7.7	2.3 to 2.7	8.0 to 9.5
V_E	5.5 to 6.8	1.6 to 2.2	7.0 to 9.0

4.7.5.4. Crystal Oscillator

With V_{B1} the subassembly remains connected to the power supply, set for a dc voltage of 5.6 V ± 50 mV (check with a digital voltmeter) at pins 11/12 against chassis ground using P3 of the test mount.

Tuning the Resonant Circuit

Connect terminal 3 of coil L2 to chassis ground. With trimmer C3 half enmeshed screw on the cover (above the crystal oscillator, Kr 1, C 3). At R 9/10 (i.e. terminal 2 of Ü1), connect an RF-Multizet meter (1-V range) against chassis ground and align the core of Ü1 for a maximum indication on the RF-Multizet meter.

Approx. ac voltage: 0.65 V

Setting the Crystal Frequency

Instead of the RF-Multizet meter, the wideband level meter (used here as an amplifier) is connected to R 9/10 (terminal 2 of Ü1) via the capacitive probe divider. With the frequency counter connected to the ac voltage output of the level meter, the oscillator frequency is measured and, with the trimmer C3, set to

f = 22.1 MHz ± 5 Hz

(if C 3 is insufficient, readjust with Ü 1)

Checking the Frequency Adjustment

The measuring setup is maintained.
Rotate potentiometer P3 fully in and out and in doing so measure the frequency difference.

$$\Delta f \geq 300 \text{ Hz}$$

Remove the link from terminal 3 of the coil L2 against chassis ground.

4.7.5.5. Free-running Oscillator

The subassembly remains connected to the power supply (V_{B1}), the cover (above L2, C30) is screwed on.

Checking the Output Level

Connect a 75-Ω termination and an RF Multizet meter to pin 25/26 with respect to pin 23/24 and measure the output voltage:

Nominal value: $V = 240$ to 280 mA

(possible alignment with R25).

Frequency Setting

Power supply and wideband level meter remain connected.

A frequency counter is additionally connected to the ac voltage output of the level meter and a further dc voltage $V_{B2} = 7.8 \text{ V} \pm 50 \text{ mV}$ (to be set with a digital voltmeter) applied to the pins 1/2 (positive) and 3/4 (negative). With C30 of the subassembly, set the nominal frequency of the oscillator (with the box above C30, L2 closed)

$$f_{7.8V} = 21{,}600 \text{ MHz} \pm 2 \text{ kHz}$$

When the voltage is changed to $V_{B2} = 4$ V, the frequency must drop to

$$f_{4V} \leq 21{,}500 \text{ MHz}$$

Checking the Output Voltage

The level meter remains connected to pins 25/26 and 23/24 and is switched to rms-response.
When V_{B2} is changed from 3.0 to 12 V, the level variation at pins 25/26 must not exceed 0.6 dB.

$$\Delta p \leq 0.6 \text{ dB}$$

Waveform of the Output Voltage

Connect an oscilloscope with a sampling plug-in to pins 25/26 of the subassembly and check the waveform of the output voltage at V_{B2} = 4 V. A pure sine wave (approx. 24 MHz) must be displayed.

4.7.5.6. Modulator

Checking the Output Level

Apply the following voltages (checked with a digital voltmeter) to the subassembly:

V_{B1} = 16 V ± 0.1 V; voltage at pins 11/12 against chassis ground $V_{11/12}$ = 7.8 V ± 50 mV

V_{B2} = 4.0 V ± 50 mV

Using an RF-Multizet meter (200-mV range) measure the output voltage at pins 15/16 against chassis ground:

$$V_{ac} = 155 \text{ mV} \pm 5 \text{ mV}$$

Checking the Frequency

The subassembly remains connected to the supply voltage V_{B1} = 16 V ± 0.1 V, apply $V_{11/12}$ = 5.6 V ± 50 mV to pins 11/12 and V_{B2} = 7.8 V ± 50 mV to pins 1/3.
The output frequency of the modulator is to be measured with a frequency counter (via a wideband level meter of high impedance and a capacitive probe divider connected between pins 15/16 and chassis ground).

$$f = 500 \text{ kHz} \pm 2 \text{ kHz}$$

4.7.6. Phase Modulator/Search Oscillator -D5133-

4.7.6.1. Measuring Instruments Required

1 level oscillator, e.g. W231
1 level meter, e.g. D354
1 oscilloscope
1 /uA-Multizet meter

4.7.6.2. Input Current

Connect the subassembly at pins 13/14 to the -D2006- through a /uA-Multizet meter (100-mA range). The /uA-Multizet meter should read

$$Io = 18\ mA \pm 3\ mA$$

4.7.6.3. DC Voltages

Check the following dc voltages with a /uA-Multizet meter against chassis ground:

V	Ts1	Ts2	Ts3	Ts4
V_K	5.8 to 7.4	12.0 to 17.0	9.5 to 12.0	10.5 to 13.0
V_B	1.9 to 2.4	6.0 to 7.2	3.0 to 3.6	3.5 to 4.3
V_E	1.4 to 1.8	5.3 to 6.5	2.5 to 3.1	3.1 to 3.7

V	Ts5	Ts6
V_K	-	0
V_B	0.7 to 0.9	-
V_E	0.15 to 0.25	0.8 to 1.0

4.7.6.4. Amplifier

The level is to be measured at the emitter of Ts2 with a level meter (of high impedance, wideband coaxial mode):

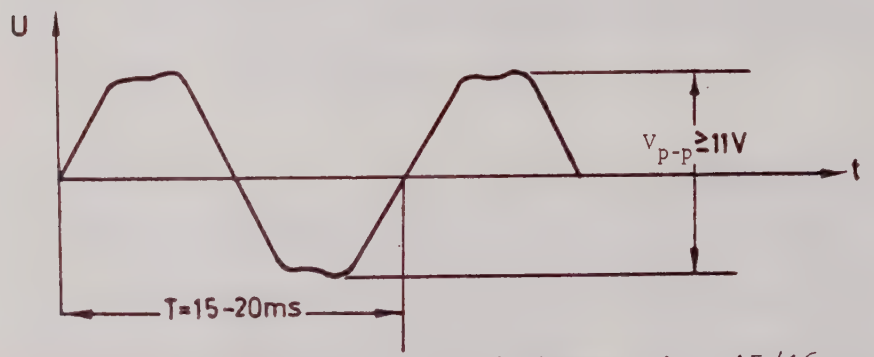
Nominal value: $p = +10\ dB \pm 3\ dB$

4.7.6.5. Search Oscillator

Screw the coaxial cable to -D5133- off the jack 'Bu12' of oscillator f_2 (no voltage is thus present at pins 30/31 of the -D5133-) and disconnect the voltage from pins 15/16 of the subassembly. All other terminals of the subassembly to -D2006- remain connected.

Checking the Oscillator Voltage

Connect the oscilloscope between the collector of Ts3 and chassis ground and measure the voltage.



Re-establish the connection between pins 15/16 and equipment unit -D2006-.

4.7.6.6. Checking the Fault Indication

Connect a level oscillator ($Z_i \approx 0\,\Omega$) to the coaxial cable disconnected from 'Bu12' of the oscillator f_2. Check by reference to the following table:

Level oscillator connected to coaxial cable		-D2006-	
f	p	Relay	Lamp 'Lp2'
550 kHz	-8 dB	operated	lights
550 kHz	+1 dB	restored	does not light
>680 kHz	+3 dB	operated	lights
<420 kHz	+3 dB	operated	lights
<680 kHz	+3 dB	restored	does not light
>420 kHz	+3 dB	restored	does not light

The frequency limits within which the lamp lights, or does not light, can be adjusted with the trimmer C30 of subassembly -D5132-.

4.7.7. Modulator 1 -D5135-

4.7.7.1. Measuring Instruments Required

1 level generator W2021
1 level receiver D2021
2 frequency generators G2021
1 signal generator W56
1 level oscillator W38
1 level oscillator W2006
1 level meter D2006
1 superheterodyne receiver U420
1 superheterodyne receiver U415
1 oscilloscope with sampling plug-in, e.g. Siemens Oszillar M214 with sampling plug-in
2 variable low-pass filters, Zi/Za = 75Ω
1 inductance bridge R114
1 RF Multizet meter
1 /uA-Multizet meter

4.7.7.2. Accessory Items

1 dc power supply, 16 V regulated
1 resistor of 60Ω ± 2%
1 resistor of 79Ω ± 2%
1 resistor of 82Ω ± 1%
1 resistor of 400Ω ± 1%

4.7.7.3. Input Current

Check the input current of the subassembly using a /uA-Multizet meter (100-mA range).

Nominal value: Io = 90 mA ± 10 mA

4.7.7.4. DC Voltages

Check the following dc voltages using a /uA-Multizet meter against chassis ground:

Voltage at the emitter of Ts9 V_{dc} = 10.5 to 11.5 V (adjust with R50)

V_{dc}	Ts1	Ts2	Ts3	Ts4
V_K	15.0-16.0	13.1-14.1	5.9-6.9	14.5-15.2
V_B	4.5- 5.5	6.5- 7.5	1.2-2.0	7.6- 8.6
V_E	4.0- 5.0	5.9- 6.9	0.5-0.9	7.0- 8.0

V_{dc}	Ts5	Ts6	Ts7	Ts8
V_K	14.5-15.2	12.1-14.0	10.5-12.0	13.0-15.5
V_B	5.7- 6.7	4.2- 5.2	6.4- 7.4	6.2- 7.2
V_E	5.0- 6.0	3.5- 4.5	5.7- 6.7	6.0- 7.0

Ts9 V_K = 14.5 - 15.5 V_B = 13.5 - 15.5

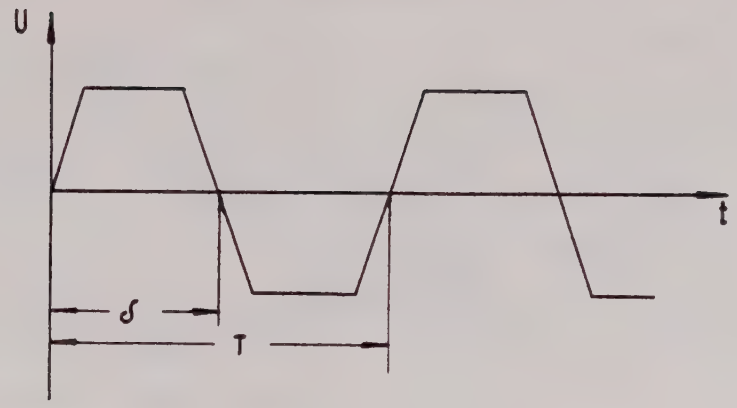
4.7.7.5. Carrier Amplifier

Set the f_1-oscillator, in the lock-in mode, for f_1=1 MHz. Measure the voltage at the emitter of Ts6 using an RF Multizet meter:

Nominal value: V_{ac} = 1.1 to 1.6 V

Waveform at the output of the Carrier Amplifier:

At the frequencies f_1 = 1.6 to 16 MHz, check the waveform at the emitter of transistor Ts9 using the oscilloscope.

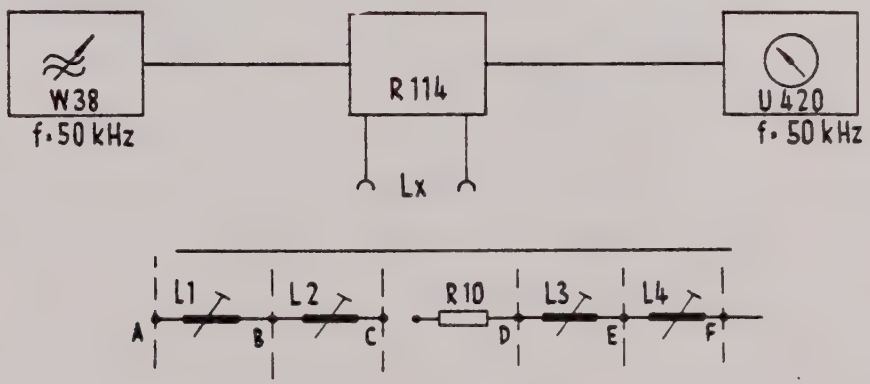


Nominal value: Amplitude V_{p-p} = 2.5 to 3.5 V
Ratio of the positive and negative half-waves = 1:1

At f_1 = 1 MHz set a unity ratio of the positive and negative half-waves using the potentiometer R50 of the subassembly.
At the frequencies specified, the waveform should correspond to the form shown, the amplitude must remain stable.
At terminal 4 of Ü1, the voltage should amount to half the value of that at the emitter of Ts9, i.e.
V_{p-p} = 1.25 - 1.75 V.

4.7.7.6. Aligning the Low-pass Filter

For aligning the coils L1, 2, 3, 4 disconnect the level meter -D2006-.



For the alignment open the link next to resistor R10.
Before measuring the coil inductances, measure the in-

ductance Lo of the connecting cables of the R114 to the specimen.

Carry out the alignment by reference to the following table:

Tuning on	Connection between chassis ground and point	Feeding against chassis ground at point	Tuning to indication	Notes
L_2	B	C	1.86 µH+Lo	
L_1	A	C	4.08 µH+Lo	L_1+L_2=2.22 µH + 1.86 µH
L_3	E	D	1.62 µH+Lo	
L_4	F	D	3.36 µH+Lo	L_3+L_4=1.62 µH + 1.74 µH

After each aligning operation remove the short circuits (2nd column of the table).

After complete alignment resolder the link next to resistor R10.

Pole Alignment, Pole f = 24 MHz

Reenergize the equipment unit.

Connect a level oscillator (W2021+G2021) with p = 0 dBm, f = 24 MHz with lock-in, Z = 75Ω to the input jack 'Bu1' of the -D2006- and a level receiver -D2021- synchro-tuned with the level oscillator to jack 'Bu1' of sub-assembly -D5135-. Set the attenuator of -D2006- in the position -80 dB (or -70 dBm, -9Np) and disconnect the instrument by inserting a coaxial plug into jack 'Bu6' of the -D2006-.

For aligning, connect point A to point C, and point E to point F (see alignment of the coils). With the core of L3 align for minimum indication on the D2021:

Nominal value: $p \leq 70$ dB

Checking the Pass Band

Level oscillator and level meter remain connected as previously, the -D2006- also remains at the same setting.

Level oscillator: p = -20 dB, f = 100 kHz, with lock-in
Level meter: p = -30 dB, bandwidth 3.1 kHz
Set the trimmer C2 to mid-position.
Measure the basic attenuation of the band-pass filter.

Nominal value:

$$a_o = 13 \text{ dB} \pm 0.5 \text{ dB}$$

Measuring the Frequency Response

As in the case of the pass band check, the level oscillator and the level meter remain connected. For this measurement, the frequency response of the level oscillator and level meter must be known.
Bypass the resistor R4.
Nominal values of the low-pass filter:

0.01 to 14 MHz	$\Delta p = 0 \pm 0.1$ dB
14 to 15 MHz	$\Delta p = -0.05 \pm 0.1$ dB
16 MHz	$\Delta p = -0.15 \pm 0.1$ dB (1)

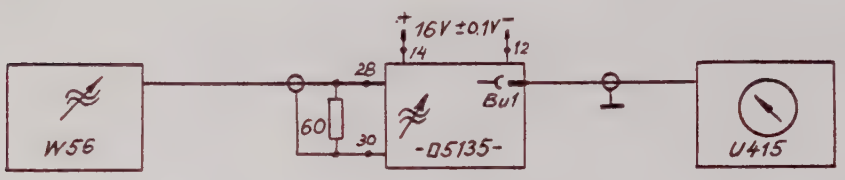
(1) With the coil 'L1', set the waveform in such a manner that the value p = -0.15 dB (see nominal values of the low-pass filter) is reached at f = 16 MHz.

Remove the short circuit of R4 again.

Stop-band Attenuation

For this measurement, remove the subassembly from -D2006- and operate it in the measuring circuit shown.

Insert the subassembly into a shielding plate corresponding to the shield in the mainframe.



f = 23.8 to 65 MHz

V_{ac} = 0.25 V

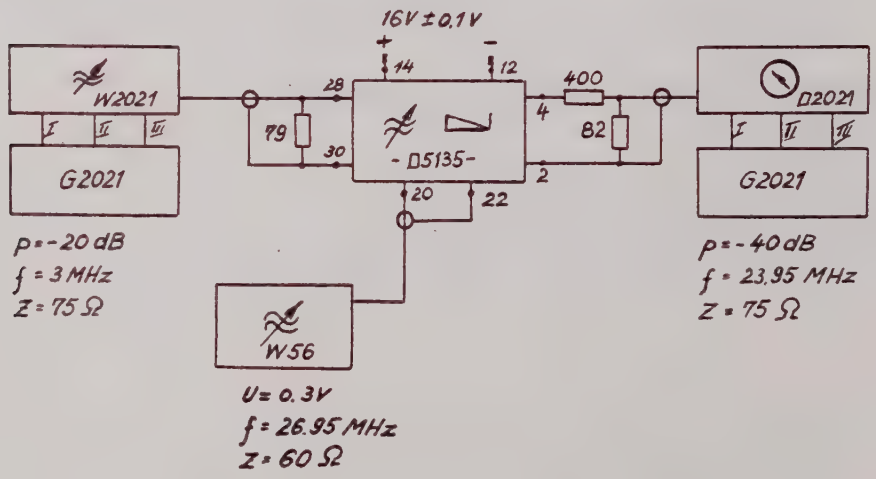
Z = 60 Ω

Measure the stop-band attenuation in the frequency range f = 23.8 MHz to 65 MHz.

Nominal value: $p \leq -90$ dB

3.7.7.7. Basic Attenuation of the Modulator

Also for this measurement, the subassembly is to be operated outside the -D2006- in the following measuring circuit.



Using the transformer Ü3 of the subassembly align for maximum indication on the D2021+G2021.
The level indicated subsequently on the level meter should amount to

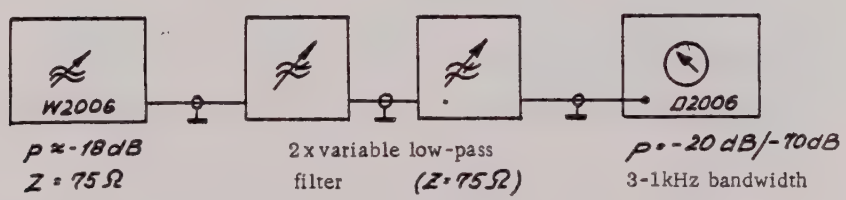
$$p = -46.5 \pm 1.5 \text{ dB}$$

3.7.7.8. Frequency Response of the Subassembly

The frequency response can be best checked in a 17-MHz measuring setup.
For this purpose the specimen, i.e. subassembly -D5135-, instead of the built-in modulator 1, is inserted into -D2006- and the level oscillator W2006 and level meter D2006 are operated in the synchro-tuned mode (f_1 and f_2).
With the trimmer C2 and, if necessary, with the resistor R4, align the subassembly for minimum frequency response (take the frequency response of the level oscillator into account).
Nominal values:

0.01 to 12.5 MHz	$\Delta p \leqq$	$\pm$ 0.05 dB
12.5 MHz to 16 MHz	$\Delta p \leqq$	$\pm$ 0.1 dB
16 MHz to 17 MHz	$\Delta p \leqq$	$\pm$ 0.3 dB

3.7.7.9. Residual Distortion Attenuation



The subassembly under test is to be inserted again into a level meter -D2006- the residual distortion of which exceeds 70 dB. The variable low-pass filter is to be set in each case in such a manner that it passes the transmitting frequency, while rejecting higher frequencies.
For carrying out the measurement switch the level meter from p = -20 dB to p = -70 dB.

Check the residual distortion by reference to the following table:

Level oscillator p approx. -18 dB	Level meter
f = 10 kHz	f = 10 kHz p = -20 dB f = 20 kHz p $\leqq$ -90 dB $\triangleq$ a_{k2} $\geqq$ 70 dB f = 30 kHz p $\leqq$ -90 dB $\triangleq$ a_{k3} $\geqq$ 70 dB
f = 100 kHz	f =100 kHz p = -20 dB f =200 kHz p $\leqq$ -90 dB $\triangleq$ a_{k2} $\geqq$ 70 dB f =300 kHz p $\leqq$ -90 dB $\triangleq$ a_{k3} $\geqq$ 70 dB
f = 1 MHz	f = 1 MHz p = -20 dB f = 2 MHz p $\leqq$ -90 dB $\triangleq$ a_{k2} $\geqq$ 70 dB f = 3 MHz p $\leqq$ -90 dB $\triangleq$ a_{k3} $\geqq$ 70 dB
f = 5 MHz	f = 5 MHz p = -20 dB f = 10 MHz p $\leqq$ -90 dB $\triangleq$ a_{k2} $\geqq$ 70 dB f = 15 MHz p $\leqq$ -90 dB $\triangleq$ a_{k3} $\geqq$ 70 dB
f = 8 MHz	f =8.5 MHz p = -20 dB f = 17 MHz p $\leqq$ -90 dB $\triangleq$ a_{k2} $\geqq$ 70 dB

4.7.8. Modulator 2 -D5136-

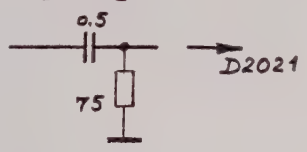
4.7.8.1. Measuring Instruments Required

1 level generator W2021
1 level receiver D2021
2 frequency generators G2021
1 RF-Multizet meter
1 µA-Multizet meter

4.7.8.2. Accessories

1 capacitor, 0.5 pF
1 resistor, 75Ω ±2%
1 coaxial plug 1.6/5.6
1 75-Ω termination

Decoupling network:



4.7.8.3. Input Current

The input current of the subassembly is to be measured with a µA-Multizet meter (30-mA range).

Nominal value: Io = 23 mA ± 3 mA

4.7.8.4. DC Voltages

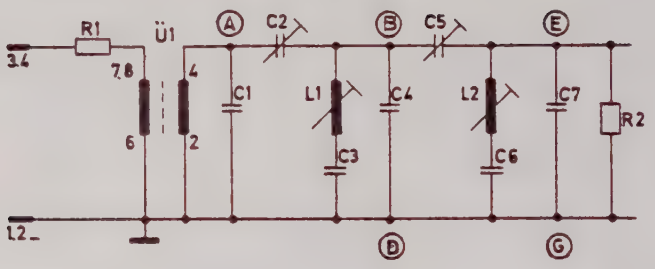
The following dc voltages to ground are to be checked with a uA-Multizet meter:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	13.8 to 14.8	13.8 to 14.8	14.3 to 15.3	14.3 to 15
V_B	10.0 to 11.0	9.0 to 10.0	9.1 to 10.1	3.1 to 4.1
V_E	9.3 to 10.3	8.5 to 9.5	8.5 to 9.5	2.6 to 3.6

4.7.8.5. Aligning the 24-MHz Band-stop Filter

A level oscillator (W2021+G2021), p = -10 dB, f = 16.1 MHz, in the lock-in mode) is to be connected to the input jack of the -D2006-, and a level meter (D2021+G2021) to terminal 4 of transformer Ü1 via the decoupling network (see accessories). The -D2006- is to be set as follows: f_1 = 16 MHz with lock-in, f_2 = 0 kHz, attenuator -80 dB (-70 dBm,) plug in jack 'Bu6'.

4.7.8.5.1. Aligning the Circuits



Band-pass filter in the -D5136-

Points (B) and (D) are to be interconnected, i.e.circuit L1/C3 is to be short-circuited.
The maximum reading is to be set on D2021, using the core of Ü1 in the -D5136-. The value 'po' indicated is to be recorded. The connection (B) - (D) must be removed.

Points (E) and (G) are to be interconnected, i.e. circuit L2/C6 is to be short-circuited.

Align to minimum reading on D 2021 with the core of L1 and to p = po - 14.7 dB ± 0.1 dB (reading on the -D2021-). with trimmer C2

Adjustments for **minimum** reading on the D2021 are to be effected with the core of L1 following each variation at C2.
The connection (E) - (G) must be removed.
A **minimum** reading on the D2021 is to be set with the core of L2; using trimmer C5, the reading is to be set to p = po - 4.2 dB ± 0.1 dB (reading on the D2021).

Each time the setting of C5 is changed readjust the core of L2 for minimum reading on D 2021.

The aligning processes are to be repeated until no adjustments are required any longer.

4.7.8.5.2. Aligning the Pass Band

The level oscillator W2021+G2021 remains connected to the -D2006- as before, and the level meter D2021+G2021 is connected to the jack 'Bu1' of the -D5136-. The settings on the -D2006- also remain the same as described under 4.7.8.5.1. By adjusting Ü1, L1 and L2 in the -D5136-, a curve is to be set, which is flat ($\Delta p \leqq \pm 0.02$ dB) in the pass band of 23.8 to 24.1 MHz (W2021+G2021 = 16.2 to 15.9 MHz) and symmetrical about mid-band f_M = 23.95 MHz (W2021+G2021: 16.05 MHz). The 3-dB-down points shall lie at approximately f_u = 23.3 MHz (i.e. W2021+G2021: f = 16.7 MHz) and f_o = 24.6MHz (i.e. W2021-G2021: f = 15.4 MHz).

4.7.8.5.3. Checking the Basic Attenuation

The measuring setup is maintained; the frequency is to be set to 16.05 MHz on the W2021+G2021.
Using an RF-Multizet meter, the voltage V_A is to be measured at the input of the subassembly (pins 3/4), and voltage V_B at its output (measuring jack Bu1).

Nominal value: $\frac{V_B}{V_A}$ = 1.0 to 1.26

this corresponds to a gain of

$G = 1 \pm 1$ dB

4.7.8.5.4. Checking the Stop-band Attenuation

The measuring setup is maintained; the frequency is to be set on the W2021+G2021 to f = 20.7 to 21 MHz and the level to be increased to approximately 0 dB. By means of level meter D2021+G2021 the stop-band attenuation of the band-pass filter is to be measured in the range of 19.0 to 19.3 MHz (receiving frequency).

Nominal value: $a_{sp} \geqq 80$ dB

4.7.8.5.5. Aligning C25

For this purpose, modulator 2 is to be operated outside the device. With the supply voltage applied (V = 16 V ± 0.1 V dc), a level of about 0 dB (input impedance ≈ 0, f = 40.8 MHz ± 0.5 MHz) shall be fed in at pins 3/4, and the voltage (at 40.8 MHz) measured at jack 1 of modulator -D5136-. In this operation, the band-pass filter must be covered up with a shielding plate. Using C25, an alignment for minimum level (≤ - 82 dB) at jack 1 is to be made.

4.7.8.6. Carrier Amplifier

4.7.8.6.1. At an ac voltage of approx. 280 mV at pins 20/21 (measured with an RF-Multizet meter) alignment for maximum voltage (also measured with an RF-Multizet meter) is to be effected at terminal 6 of Ü2 by means of Ü2.

Nominal value: 2.9 to 3.5 V ac (at terminal 6 of Ü2)

4.7.8.6.2. Basic Attenuation

Alignment for maximum reading on the instrument of the -D2006- is now to be effected with the core of Ü3.

4.7.9. Modulator 3 -D5137-

4.7.9.1. Measuring Instruments Required

1 level oscillator, e.g. W518
1 level meter, e.g. D335
1 wideband level meter, e.g. D353
1 capacitive divider (a = 20 dB)
1 RF-Multizet meter
1 µA-Multizet meter

4.7.9.2. Input Current

The input current of the subassembly is to be measured with a µA-Multizet meter (30-mA range):

Nominal value: Io = 20 mA ± 2 mA

4.7.9.3. DC Voltages

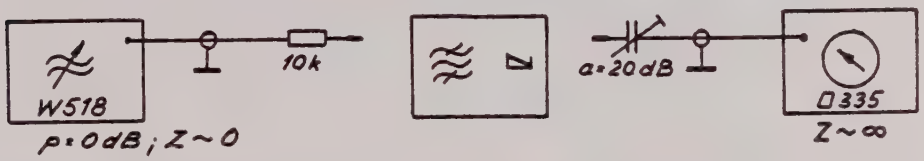
The following dc voltages to ground are to be checked with a µA-Multizet meter:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	14.4 to 15.5	8.0 to 10.0	13.7 to 14.7	14.0 to 15.0
V_B	10.0 to 11.5	2.5 to 3.3	8.0 to 10.0	1.7 to 2.4
V_E	9.6 to 10.6	1.9 to 2.7	7.4 to 9.4	1.1 to 1.8

4.7.9.4. 2.4-MHz Band-pass Filter

For aligning purposes, the subassembly is to be operated outside the -D2006-.

The supply voltage of 16 V ± 0.1 V is to be applied between pins 13/14 and chassis ground; aligning is performed in accordance with the following table:

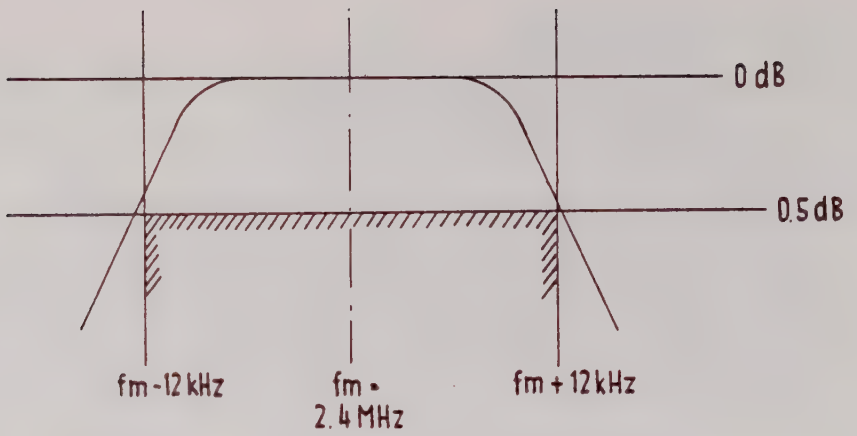


The crystal Kr of the subassembly is to be short-circuited.

-W518- p	f	feeding at	-D5137- alignment with	-D335- p	f	measuring at
0 dB	2.2MHz	L1/4	L1	≦-93dB	2.2 MHz	L1/4
0 dB	2.2MHz	L2/4	L2	≦-93dB	2.2 MHz	L2/4
0 dB	2.4MHz	pins 28/29	L3	-20dB± 1dB	2.4 MHz	emitter Ts1

The data of the band-pass filter are to be checked (align with L1, 2 and 3, if required):

Drop-off of the curve by a = 0.5 dB at f_M = 2.4 MHz ± 12 kHz, pass-band ripple up to 0.05 dB.



The short-circuit at crystal Kr is to be removed after the alignment has been carried out, and coils 1, 2 and 3 are to be protected against turning.

4.7.9.5. Crystal Oscillator, f = 2.3 MHz

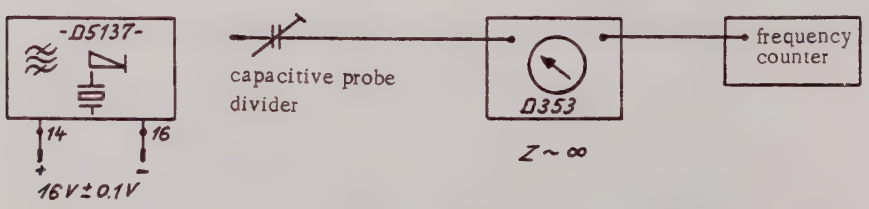
The subassembly remains connected to the power supply (V = 16 V ± 0.1 V dc) as under 4.7.9.4., the short-circuit at crystal Kr being removed.

Aligning Ü1

A µA-Multizet meter (100-µA range) is to be connected to R24 of the subassembly (Multizet meter in parallel to R24). Aligning for maximum reading on the Multizet meter is to be effected at Ü1.

Nominal value: I ≈ 40 µA

Setting the Oscillator Frequency



The capacitive probe divider is to be connected to terminal 1 of transformer Ü1.

The frequency of the crystal oscillator can thus be measured via the capacitive divider and the wideband level meter.
Using trimmer C18, the oscillator frequency is now to be set to

$$f = 2.3 \text{ MHz} \pm 5 \text{ MHz}.$$

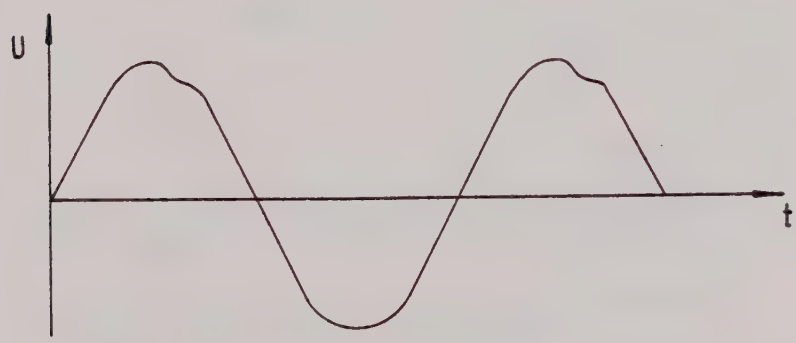
Amplitude

Using an RF-Multizet meter, the voltage to ground is to be measured at terminal 1 of transformer Ü1.

Nominal value: $V = 2.5 \text{ V ac} - 3 V_{rms}$

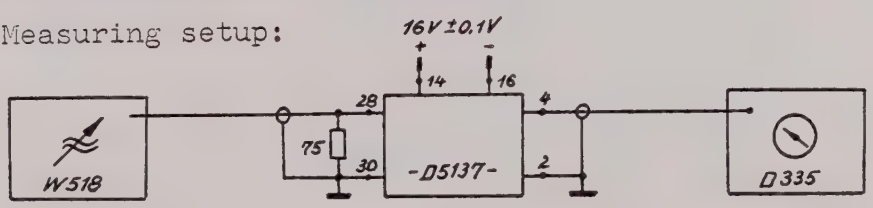
Waveform

The waveform of the voltage is to be checked at terminal 1 of transformer Ü1 by means of an oscilloscope.



4.7.9.6. Functional Check of the Board

Measuring setup:



p = -30 dB
$Z_i \approx 0\,\Omega$
f = 2.4 MHz, lock-in mode

p = - 10 dB
$Z \approx \infty$
f = 100 kHz, lock-in mode

Aligning Ü2

In the circuit configuration of the measuring setup, transformer Ü2 of the subassembly is to be aligned for maximum level meter reading.

Nominal value: p = -17.8 ± 0.5 dB (reading on D335)

4.7.10. 80-Hz Crystal Filter -D5138-

4.7.10.1. Measuring Instruments Required

1 level oscillator, e.g. W231
1 level meter, e.g. D354
1 frequency counter
1 scale spread device
1 µA-Multizet meter

4.7.10.2. Accessories

1 dc power supply, 16 V regulated
1 resistor, 75 Ω ±2%

4.7.10.3. Input Current

The input current of the subassembly is to be measured with a µA-Multizet meter (10-mA range).

Nominal value: Io = 4.7 mA ± 1 mA

4.7.10.4. DC Voltages

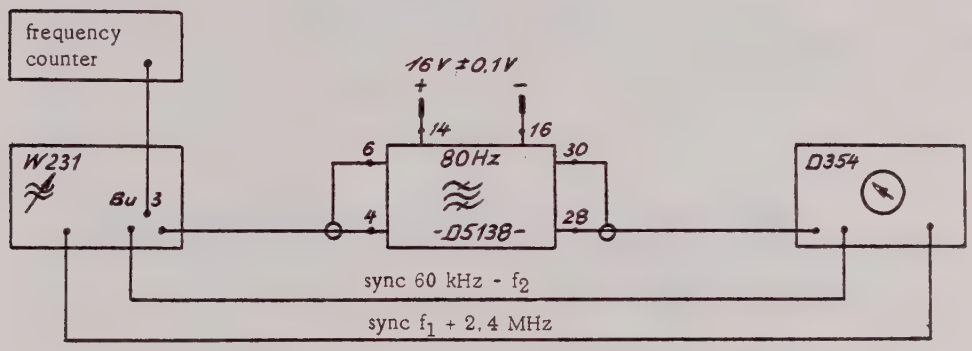
Using a µA-Multizet meter, the following dc voltages to ground are to be checked:

Ts1: V_K = 14.5 to 15.5 V
V_B = 7.2 to 8.2 V
V_E = 6.6 to 7.6 V

4.7.10.5. Aligning the Band-pass Filter

Measuring setup:

It is of advantage to align the band-pass filter in a heating chamber at approx. 40 to 45°C.



W231: p = 0 dB
Z ≈ 0
f = 80 kHz ± 0.1 kHz

D354: selective, calibrated
Z = 10kHz ‖ 60 pF

Align f_2 of the oscillator for maximum reading on the receiver.

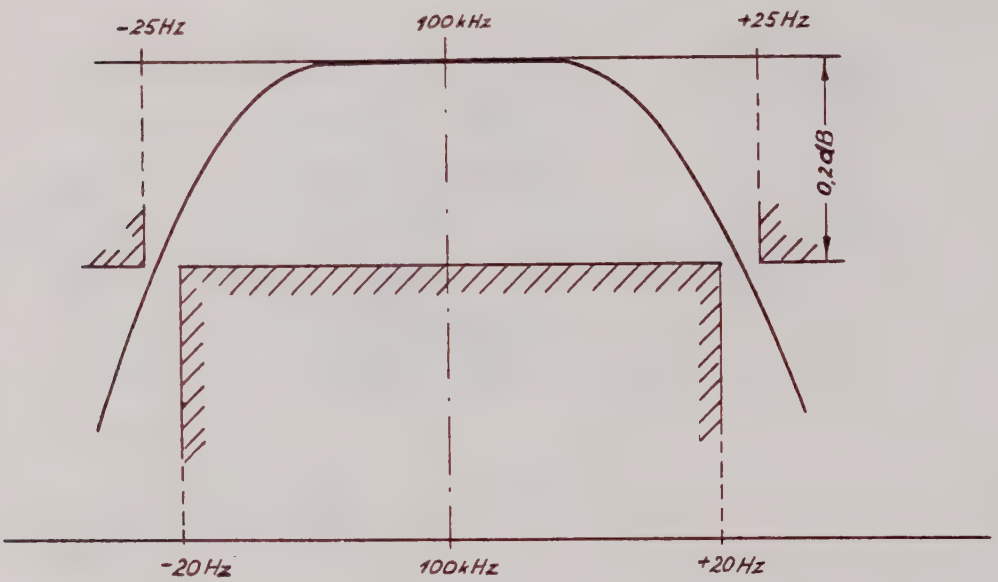
Aligning the Poles as per Table

Short-circuiting and connecting, resp. (1)	Frequency at W231	Set reading min. with	P_{min}	Remove short-circuit
Kr2 + Kr3	80 kHz ±100 Hz	C2	≦-83dB or ≦-9.5Np	Kr2+Kr3
Kr1 + Kr3		C4		Kr1+Kr3
Kr1 + Kr2		C7		Kr1+Kr2

(1) with short wire

Aligning Ü1, Ü2, Ü3

Transmitting frequency f = 100 kHz ± 10 Hz (lock-in mode), level meter in position 0 dB (0 Np).
Align Ü1, Ü2, Ü3 for maximum level meter reading; following this, use Ü1, Ü2 and Ü3 again to set the following form of the filter characteristic:



After aligning, the filter curve must lie outside the tolerance fields shown in the diagram.

4.7.10.6. Setting the Gain

The measuring setup is maintained, but the transmitting level is to be set to p = -20 dB and the frequency to f = 100 kHz ± 20 Hz. The scale-spread device must be connected to the level meter. Using potentiometer R3, the gain of the subassembly is so to be set that identical levels appear at the input (pins 3/4) and output (pins 28/29).

Nominal (numerical) value: 1 ± 0.1%

4.7.10.7. Stop Band

The scale-spread device is to be disconnected from D354.

At a frequency departure of $\Delta f = \pm 400$ Hz from mid-band, the level meter reading must return to $p \leqq -73$ dB, i.e. a stop-band attenuation of

$$a \geqq 53 \text{ dB} \quad \text{at} \quad \Delta f = \pm 400 \text{ Hz}$$

With a frequency departure of $\Delta f = \pm 1$ kHz from mid-band, the level meter reading must return to $p \leqq -91$ dB, i.e. the stop-band attenuation must be

$$a \geqq 71 \text{ dB} \quad \text{at} \quad \Delta f = \pm 1 \text{ kHz}$$

At approximately 228 kHz, the reading on D354 must return to $p \leqq -56$ dB, i.e. the stop-band attenuation must be

$$a \geqq 36 \text{ dB} \quad \text{at} \quad f \approx 228 \text{ kHz}$$

4.7.11. 3.1-kHz Coil-type Filter -D5139-

4.7.11.1. Measuring Instruments Required

1 level oscillator, e.g. W231
1 level meter, e.g. D335
1 scale-spread device, e.g. B977
1 frequency counter
1 capacitive probe divider (a = 20 dB)
1 /uA-Multizet meter

4.7.11.2. Accessories

1 dc power supply, 16 V regulated
1 resistor, 30 kΩ ±5%
1 capacitor, 1 /uF ±10%

4.7.11.3. Input Current

The subassembly -D5139- is to be connected to the dc power supply (V_B = 16 V ± 0.1 V) via a µA-Multizet meter (10-V range), i.e. plus pole to pins 13/14, and minus pole to pins 15/16.
The input current shall be

$$Io = 9 \text{ mA} \pm 1 \text{ mA}.$$

4.7.11.4. DC Voltages

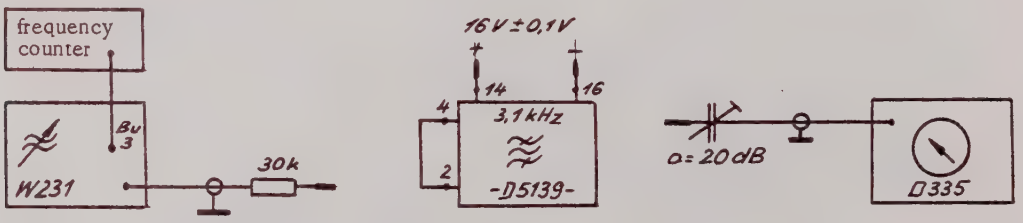
The following dc voltages to ground are to be checked with a µA-Multizet meter:

Volts	Ts1	Ts2
V_K	14.5 to 15.5	14.5 to 15.5
V_B	8.5 to 9.5	7.3 to 8.3
V_C	7.9 to 8.9	6.7 to 7.7

4.7.11.5. Aligning the Band-pass Filter

It is of advantage to align the band-pass filter in a heating chamber at approx. 40 to 45°C.

Measuring setup:



W231: p = 0 dB
Z ≈ 0
f = 100 kHz ± 20 Hz

Z ≈ ∞
f = 100 kHz

4.7.11.5.1. Aligning the Circuits

Via the 30-kΩ resistor, the test signal is to be fed into the resonant circuit mentioned in the following table and, at the same time, measurements are to be made with the level meter at the feed-in point via the capacitive probe divider (a = 20 dB, calibrated). In soing so, the frequency is to be retuned on the level meter.

Alignment for maximum level meter reading is to be effected on the transformers of the subassembly (as per table).

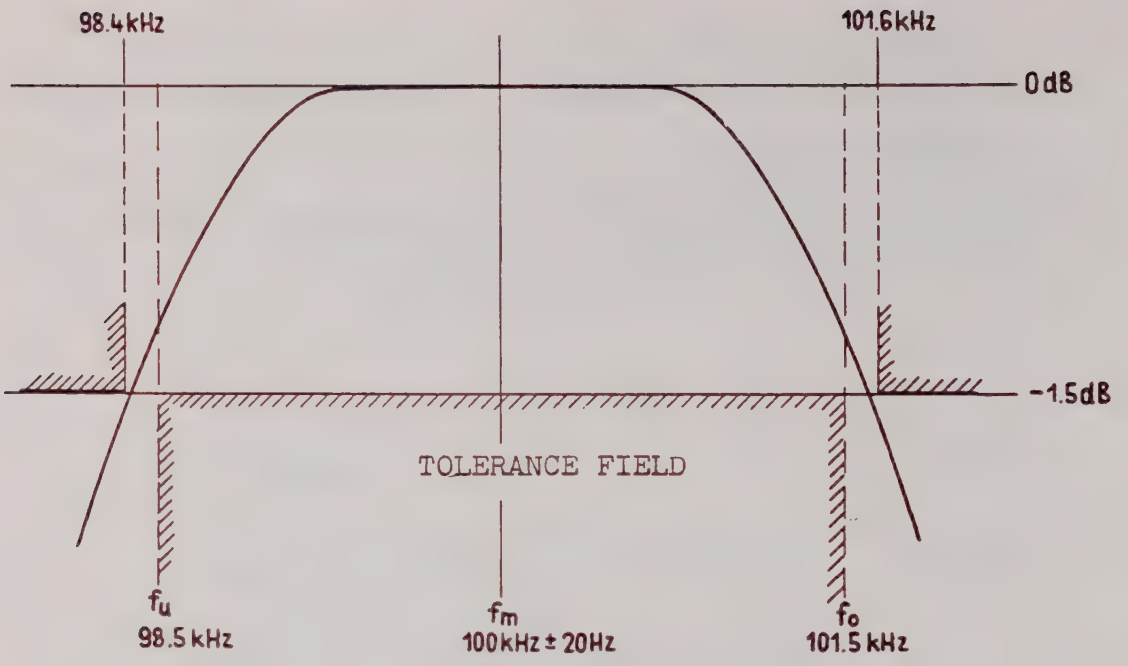
Feeding and measuring at	Short- circuiting of	Alignment on:	Reading maximum dB (1)
Terminal 1 of Ü1	Ü2	Ü1	≧ - 39 dB
Terminal 2 of Ü3	Ü2	Ü3	≧ - 35 dB
Terminal 1 of Ü2	Ü1 and Ü3	Ü2	≧ - 26 dB
Terminal 1 of Ü4	Ü5	Ü4	≧ - 39 dB
Terminal 2 of Ü6	Ü5	Ü6	≧ - 35 dB
Terminal 1 of Ü5	Ü4 and Ü6	Ü5	≧ - 26 dB

(1) These values include the attenuation of the capacitive probe divider (a = 20 dB).

4.7.11.5.2. Aligning the First Section of the Band-pass Filter

The signal of the level oscillator (p = -10 dB, Zi (source impedance)≈0, f = 100 kHz ±20 Hz) is fed in at pins 3/4 against chassis ground via a 1-µF capacitor. Terminal 2 of transformer Ü4 is to be connected to chassis ground, and the level meter to the emitter of Ts1 via the capacitive probe divider.

The following form of the filter curve is to be set with Ü1, Ü2 and Ü3.



After alignment, the filter curve must lie outside the tolerance fields.

Notes on Alignment:

(a) First set a flat top of the pass-band curve with Ü1 and Ü3 (ripple $\leq$ 0.03 dB).

(b) Should the pass-band curve have different curvatures at the band limits, Ü1 and Ü3 must be adjusted in opposite senses in such a manner that identical curvatures and a flat top result.

(c) Unsymmetries of the pass-band curve about the mid-frequency:
f_m = 100 kHz: If the curve is situated too far to the right (left), all inductances (Ü1, Ü2, Ü3) must be slightly increased (decreased). When the aligning process has been performed, the short-circuit across transformer Ü4 must be removed, and the cores of transformers Ü1, Ü2 and Ü3 protected against turning.

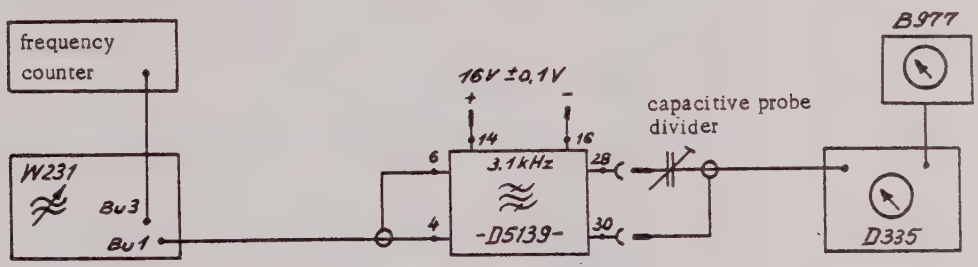
 meter.

4.7.11.5.3. Aligning the Second Section of the Band-pass Filter

The signal is fed into the base of Ts1 via the 1-µF capacitor instead of being injected into pins 3/4. Terminal 1 of Ü3 is to be connected to chassis ground, and the level meter to pins 28/29.
Using Ü4, Ü5, and Ü6, the same form of the filter curve as described under 4.7.11.5.2. is to be set.
When the aligning process has been performed, the short-circuit across transformer Ü3 is to be removed, and the cores of transformers Ü4, Ü5 and Ü6 are to be protected against turning.

4.7.11.6. Setting the Gain

Measuring setup:



W231: p = - 20 dB
$Z_i \approx 0\ \Omega$
f = 100 kHz ± 20 Hz

D335: p = -40 dB
$Z \approx \infty$
f = 100 kHz

Using potentiometer R10, the gain of the subassembly is to be set in such a manner that the levels at the input (pin 3/4) and output (pin 28/29) are identical.

Nominal (numerical) value: 1 ± 0.1%

4.7.11.7. Data of the Band-pass Filter

Mid-band:
The mid-band shall be at

f = 100 kHz ± ~~100~~ 2Ω Hz.

Pass band width (Δa = 0.2 dB)

By detuning the frequency on the W231 (check with frequency counter), the frequency departure from the mid-frequency is to be determined at a level drop of 0.2 dB.

Nominal value:

$$\Delta f \geq \pm 800 \text{ Hz at } \Delta a = 0.2 \text{ dB}$$

Bandwidth ($\Delta a = 3$ dB)
The scale-spread device is to be disconnected from the level meter.
By detuning the frequency on the W231 (check with frequency counter), the frequency departure from the mid-frequency is to be determined with a level drop of 3 dB.

Nominal value:

$$\Delta f = \pm 1.50 \text{ to } \pm 1.60 \text{ kHz}$$

Stop-band attenuation:
The level meter is to be connected to pins 28/29 of the subassembly without the capacitive probe divider.

At a frequency departure of $\Delta f = \pm 10$ kHz from the mid-frequency of 100 kHz, the level meter reading must return to $p \leq -95$ dB, i.e.

a stop-band attenuation of

$$a \geq 75 \text{ dB} \quad \text{at } \Delta f = \pm 10 \text{ kHz}$$

4.7.12. 100-kHz Preamplifier -D5140-

4.7.12.1. Measuring Instruments Required

1 level meter, e.g. D335
1 capacitive probe divider (a = 20 dB)
1 /uA-Multizet meter

4.7.12.2. Input Current

The input current of the subassembly is to be measured with a /uA-Multizet meter (30-mA range):

Nominal value: $I_o = 12 \text{ mA} \pm 2 \text{ mA}$

4.7.12.3. DC Voltages

Using a µA-Multizet meter, check the following dc voltages against chassis ground:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	9.0 to 11.0	13.7 to 14.7	13.7 to 14.7	14.7 to 15.7
V_B	1.5 to 1.7	9.0 to 11.0	8.4 to 10.4	6.4 to 7.4
V_E	0.8 to 1.0	8.4 to 10.4	7.7 to 9.7	6.1 to 7.1

4.7.12.4. Gain

Set the sensitivity switch of the -D2006- in the position 'calibrating' and, at the frequency f = 100 kHz, tune for maximum indication on the instrument (with f_2). Using the level meter, measure the level at pins 28/29 and pins 19/20 via the capacitive probe divider.

Pins 28/29 approx. 57.6 dB
Pins 19/20 approx. 28.9 dB
} $\Delta p = V = 28.7$ dB $\pm$ 0.5 dB

Hence, the gain of the subassembly, i.e. pins 28/29 to pins 19/20 amounts to 28.7 dB $\pm$ 0.5 dB.
The same level must appear at pins 9/10 and pins 3/4, i.e. unity gain.

4.7.13. 100-kHz Final Amplifier -D5141-

4.7.13.1. Measuring Instruments Required

1 level meter, e.g. D335
1 capacitive probe divider
1 µA-Multizet meter

4.7.13.2. Input Current

Using a µA-Multizet meter (30-mA range), measure the input current of the subassembly:

Nominal value: Io = 26 mA $\pm$ 2 mA

4.7.13.3. DC Voltages

Using a µA-Multizet meter, check the following dc voltages against chassis ground:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	9.0 to 11.0	15.0 to 15.4	7.5 to 8.6	14.6 to 15.0
V_B	2.5 to 3.0	9.0 to 10.5	1.8 to 2.1	7.5 to 8.6
V_E	1.9 to 2.5	8.0 to 10.0	1.2 to 1.5	6.9 to 8.0

4.7.13.4. Gain

Turn the sensitivity switch of the -D2006- to the calibrating position, set f_1 to 100 kHz, in the lock-in mode, and tune f_2 for a maximum indication on the instrument.

Now, set the core of transformer Ü1 for a maximum indication on the instrument.

Using a level meter, measure the level at pins 28/29, pins 3/4 and pins 7/8 via the capacitive probe divider:

Pins 28/29 p = -51.3 dB ± 0.5 dB
Pins 3/4 p = + 9 dB ± 0.5 dB

p = 60.3 dB + 1 dB = V

Pins 28/29 p = -51.3 dB ± 0.5 dB
Pins 7/8 p = + 4 dB ± 0.5 dB

p = 55.3 dB ± 1 dB = V

(possibly an alignment with R4).

4.7.14. Output Section -D5142-

4.7.14.1. Measuring Instruments Required

1 level meter, e.g. D335
1 level oscillator, e.g. W518
1 capacitive probe divider (a = 20 dB)
1 digital voltmeter
1 frequency counter
1 μA-Multizet meter
1 oscilloscope

4.7.14.2. Accessory Items

1 600-Ω termination
1 resistor, 3 kΩ ± 1%

4.7.14.3. Input Current

Using a μA-Multizet meter (30-mA range), measure the input current of the subassembly:

Nominal value: Io = 13.5 mA ± 2 mA

4.7.14.4. DC Voltages

Using a μA-Multizet meter, check the following dc voltages:

Volts	Ts1	Ts2	Ts3	Ts4
V_K	6.6 to 8.6	7.5 to 8.5	14.4 to 15.0	14.4 to 15.0
V_B	0.3 to 0.6	1.8 to 2.6	7.5 to 8.5	2.0 to 2.8
V_E	0.15	1.2 to 2.0	6.9 to 7.9	1.4 to 2.2

4.7.14.5. Measuring Circuit

p = 0 dB/0 dBm
f = 100 kHz
Z = 75 Ω

p=0 dB/0 dBm
f= 100 kHz
3.1-kHz bandwidth

f = 100 kHz
Z = ∞

Connect the level meter to pins 7/8 of the subassembly -D5142- via the capacitive probe divider, and a 3-kΩ resistor (instead of the instrument) to pins 1/2 against chassis ground. First tune the -D2006- to the transmitting frequency and subsequently D335 to the -D2006-. Set the transmitting level in such a manner that a voltage of p = +9 dB ± 0.1 dB is measured at pins 7/8 (indication on D335 = -11 dB since probe divider with a = 20 dB).

Alignment 1:

Set R9 for a voltage of V_{dc} = 194 mV ± 1 mV, measured with a digital voltmeter, at pins 3/4 against chassis ground, followed by setting of 232 mV ± 1 mV with R8 at pins 1/2 (in this order).

Alignment 2:

After alignment 1 the potentiometers R5 and R8 are to be set according to the following scheme (in this order).

p7/8 = Level at terminal 7/8 of the output board -D5142-

$V_{1/2}$ = Voltage at pins 1/2, measured with a digital voltmeter against chassis ground.

p7/8 (dB)	Alignment with potentiometer	V1/2 (mV)
+ 9	R5	232 ± 1
- 1	R8	73.4± 0.3
+ 9	R5	232 ± 1
- 1	R8	73.4±0.3
+ 9	R5	232 ± 1
- 1	R8	73.4±0.3

Checking alignment 1
Check the values of alignment 1, i.e.

$V_{3/4}$ = 194 mV ± 1 mV

$V_{1/2}$ = 232 mV ± 1 mV

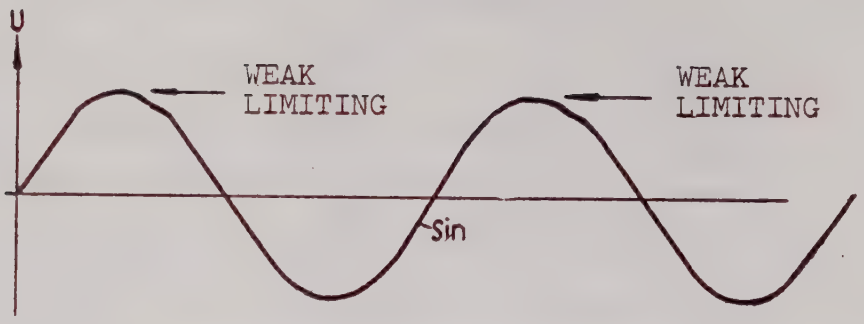
If these values are incorrect then repeat alignment 1 and, subsequently alignment 2.
Instead of the 3-kΩ resistor, connect the instrument again and set, at +9 dB, the instrument pointer on the 0-dB index line of the instrument at pins 7/8 using R8, and the voltage to 194 mV at pins 3/4 (these two settings affect each other and therefore must be repeated several times).

4.7.14.6. SSB Output

4.7.14.6.1. Oscillator

Set the switch 'S4' of the -D2006- to the left-hand stop (lower sideband).

Using the oscilloscope and the probe divider 10:1, check the voltage wave at transformer Ü1, terminal 5 against chassis ground:



Nominal value:

$$V = 13.5 - 16.5\ V_{p-p}$$

Connect a frequency counter to the oscilloscope.
C 11 is 2/3 out of mesh.
Set the frequency to f = 98.15 kHz ± 50 Hz by aligning Ü1.

4.7.14.6.2. Converter

Voltage and frequency are to be measured at pins 29/30 in the case of a level of + 4 dB at f = 100 kHz ± 10 Hz at pins 9/10 and a 600-Ω termination at jack 'Bu5' (a-wire).

p = 0 dB ± 1 dB
f = 1.85 kHz ± 10 Hz (1)

(1) Put S4 to the left-hand stop, alignment with C11. When S4 is switched to the right-hand stop, a frequency of f = 1.85 kHz ± 10 Hz must be measured again (alignment with trimmer C1 behind the front panel of the -D2006-).

4.7.14.7. Calibrating Circuit

Set the sensitivity switch of the -D2006- to the calibrating position and f_1 to 100 kHz in the lock-in mode and tune f_2 for a maximum indication on the instrument.

Connect a level meter to pins 17/18 of the subassembly via a capacitive probe divider.
Align transformer Ü2 for a maximum indication on the level meter connected to pins 17/18. The levels at pins 17/18 and pins 20/21 are to be measured against chassis ground with the same level meter and the capacitive probe divider and set them with R27 and R28 (Note: The dividers R29/31 and R30/32 must be carbon-film resistors).

Model of -D2006-	dB	dBm
Pins 17/18, alignment with R27	-50dB	-49.04dB
Pins 20/21, alignment with R28	-60dB	-59 dB

Note: Indication on level meter combined with probe divider is lower by 20 dB since the probe divider introduces an attenuation of 20 dB.

4.7.15. Power Supply Unit -D5143-

Note: The 5.5-V dc supply voltage should not be set to a value higher than 5.6 V to avoid damage to the integrated circuits. For safety, the connecting cord between pin 5 of the power supply board and subassembly -W5049- should be unsoldered at pin 5 and a resistor (36Ω, 1 W) connected between pin 5 and chassis ground as a substitution load.

4.7.15.1. Measuring Instruments Required

1 digital voltmeter
1 oscilloscope
2 µA-Multizet meter

4.7.15.2. Accessory Items

1 resistor R = 36 Ω, 1 W
1 linear resistor R approx. 100 Ω, 10 W
1 resistor R = 65 Ω/2W
3 dc power supplies, 30 V, up to 2A

4.7.15.3. Apply an ac voltage of 220 V (mains voltage adjuster at 220 V) to jack 'Bu8' of the equipment unit and set the mains switch 'S5' to 'On'. The following dc voltages (against chassis ground) must appear at the outputs of the power supply unit (measured with a digital voltmeter):

Pin 5 against chassis ground V_{dc} = 5.5 V ± 0.05 V
Pin 8 against chassis ground V_{dc} = 16 V ± 0.1 V

These voltages can be corrected, if necessary, with R16 (5.5 V) and R12 (16 V).

4.7.15.4. These dc voltages (4.7.15.3.) must also be checked in the case of 110-V mains voltage (in this case, change the fuse) and a battery supply of 24 V and 12 V at jack 'Bu9'. The same values must be measured.

4.7.15.5. Hum Voltage

In the case of a mains voltage of V_{ac} = 220 V, the hum voltage is to be measured at pins 5, 8 and 12 of the power supply board:

Pin 5 $V_{hum} \leqq 1\ mV_{p-p}$

Pin 8 $V_{hum} \leqq 1.5\ mV_{p-p}$

Repeat the measurement at V_{ac} = 198 V and V_{ac} = 264 V.

4.7.15.6. If the values specified under 4.7.15.3. to 4.7.15.5. have not been reached, check the individual subassemblies of the power supply unit separately.

4.7.15.7. DC Voltage at the Input

The dc voltage is to be measured at the electrolytic capacitor C1 with a mains voltage of 220 V:

$$V_{dc} = 25\ V \pm 2\ V$$

4.7.15.8. Power Supply Board -D5147-

Withdraw the dc/dc converter -D5148- (loosen two fastening screws under the 5-pole jack 'Bu9'). Apply 26 V dc to pin 10 (positive) with respect to pin 11 (negative) of the power supply board and 11V dc to pin 6 (positive) against pin 7 (negative).

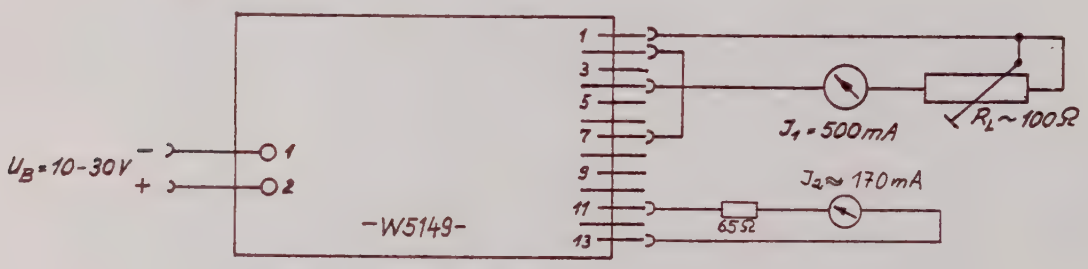
Check the following dc voltages:

	Pin 5	Pin 8	Pin 10	Pin 9	Pin 13
V_{dc}	5.5	16	26	16,5	24,5

V_{dc}	Ts4	Ts5	Ts6	Ts7	Ts10		Ts2	Ts3
V_K	17	17	20	7.3	8		25	30
V_B	-	7.5	17		6		14.2	25
V_E	0	6.9	16	0	5.5		13.6	24.8

4.7.15.9. DC/dc Converter -D5148- with Converter Board -D5149-

Operate the converter according to the following measuring setup:



4.7.15.9.1. Input Current

Connect the subassembly to the dc power supply (V_B = 24 V ± 0.1 V) by means of a uA-Multizet meter (1-A range) and measure the input current Io with a current I_1 set to 500 mA ± 10 mA with the variable resistor R_L.

$$Io = 0.8\ A \pm 0.2\ A$$

4.7.15.9.2. DC Voltages

The following dc voltages are to be measured with a uA-Multizet meter:

V_{dc}	Ts1	Ts2	Ts3	Ts4
V_K	23.0-24.5	23.0-24.5	23.0-24.0	0
V_B	-1.0--2.0	-1.0--2.0	0	19.5-21.0
V_E	0	0	0	13.0-14.2

4.7.15.9.3. Reconnection from 12 V to 24 V

When the voltage V_B is increased from 12 V to 24 V, the relay must have operated when 16 V is reached.

When the voltage V_B is reduced from 24 V to 12 V, the relay must restore again at approx. 16 V.

Output Voltages

The subassembly remains wired as under 4.7.15.9.1., i.e. V_B = 24 V ± 0.1 V, I_1 = 500 mA ± 10 mA.

The following dc voltages must be checked with a µA-Multizet meter:

Voltage at pin 4 - 1:

$$V_{4/1} \geqq 18 \text{ V}$$

Voltage at pin 11 - 13:

$$V_{11/13} \geqq 7.5 \text{ V}$$

Voltage at pin 5 - 6:

$$V_{5/6} \geqq 28 \text{ V}$$

Checking the dielectric strength:
The subassembly remains wired as under 4.7.15.9.1. and connected to the dc power supply (V_B = 24 V, I_1 = 500 mA ± 10 mA). When the voltage V_B is reduced to 12 V the current I_1 should be

$$I_1 \geqq 500 \text{ mA.}$$

Protection against incorrect polarity:
Connect the subassembly to the dc power supply (positive pole to soldering pin 1, negative pole to soldering pin 2 of the printed circuit board, V_B = 12 V) via a µA-Multizet meter. The wiring at the pin strip of -D5149- remains as under 4.7.15.9.1. The reading of the µA-Multizet meter should be

$$Io \geqq 500 \text{ µA.}$$

4.7.16. Attenuator -D2052-

4.7.16.1. Measuring Instruments Required

1 precision attenuator, e.g. D120
1 level measuring setup for up to 25 MHz, e.g.D2021+G2021+W2021
1 ohmmeter, measuring range from 0.01Ω to 200Ω
1 reflectometer bridge, e.g. R273

4.7.16.2. Visual Inspection

For making a visual inspection take the attenuator out of the instrument and screw it open. Then check the soldering joints.

4.7.16.4. Electrical Check

The switch carries the input divider with, and the IF divider without, a shield.
In all switch positions the dc error must be $\Delta p \leqq \pm 0.02$ dB ($\pm$ 3 mNp),
the frequency response of the input divider up to 17 MHz must be $\Delta p \leqq \pm 0.06$ dB ($\pm$ 6 mNp)
and the reflection coefficient at input and output of the input divider must be $\leqq 2\%$ ($a_r \geqq 34$ dB).

Pegelmesser/LEVEL METER
SIEMENS AG

FILM DRIVE, REPLACING THE SCALE FILM

The film drive is of rugged construction and requires no maintenance. The film tape which carries the scale divisions, individually applied by a photographic process, consists of particularly strong and permanent plastic special foil (Dupont Cronar Film No. 225 B 35) for the purpose of ensuring greatest accuracy in setting the frequency. Under normal conditions therefore, trouble need not be anticipated. Should a fault nevertheless occur, take down the film cassette with care, following the instructions given below and detect the fault. Never attempt to move the drive by using force. Should the film have been damaged, then insert the spare film by following these instructions. We recommend that the piece of negative film supplied with the equipment is forwarded to our works for making a new spare film after the removal of the spare film.

If the transport band (Fig. 4) has been torn, order a replacement under the order description of "Transport Band C44106-A7-C109 with 2 clips C44106-A7-C110". When placing the band in position, make sure that the lettering on the inner surface of the band is legible; insert the two clips into the overlapping perforations

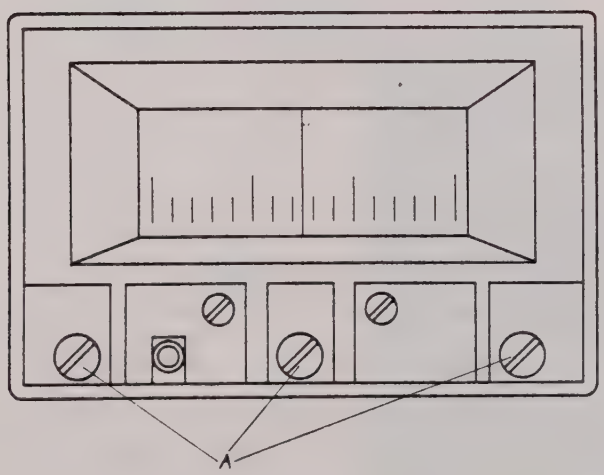


Fig. 1 Film guide

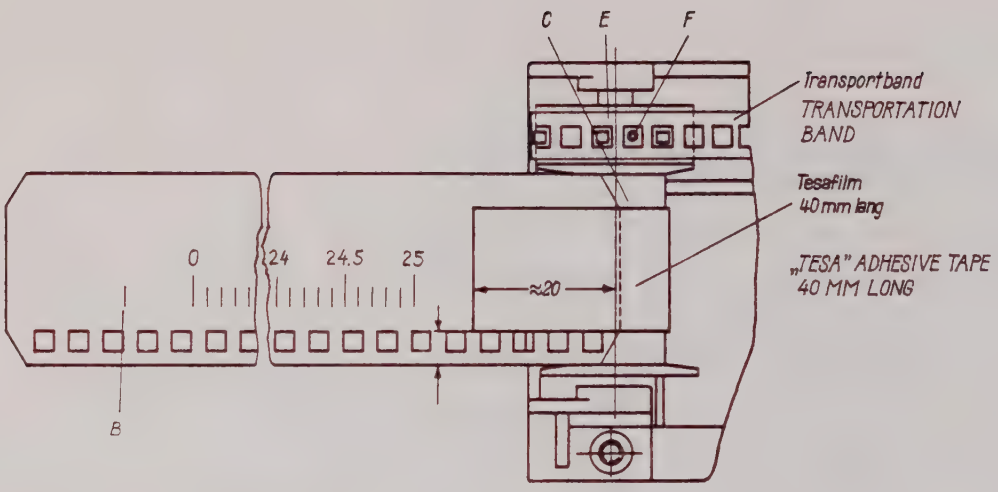


Bild 2 Ankleben des Filmband-Endes
FIG.2 CEMENTING THE END OF THE FILM BAND IN POSITION

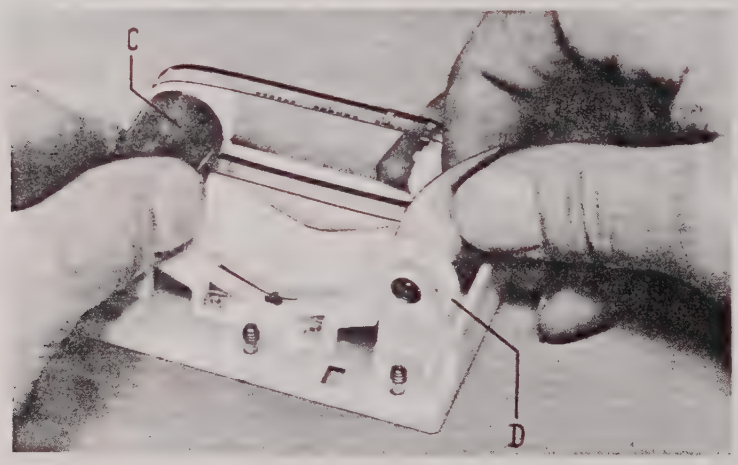


Bild 3 Ankleben des Filmband-Anfangs
FIG.3 CEMENTING THE START OF THE FILM BAND IN POSITION

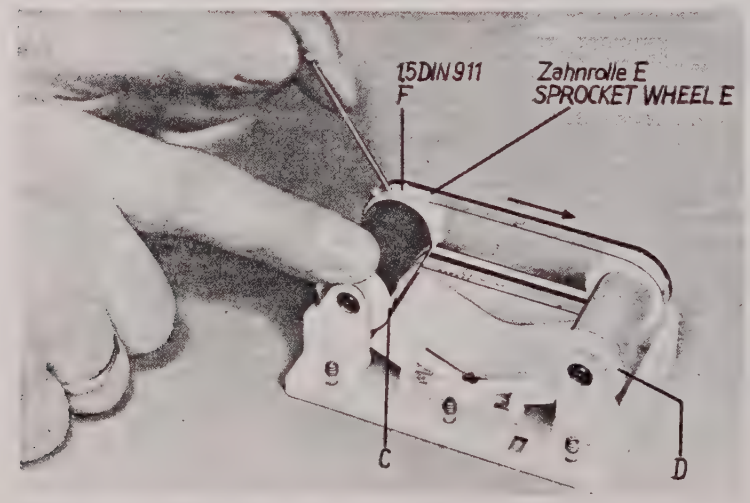


Bild 4 Lösen der Vorspannungs-Arretierung
FIG.4 RELEASING THE DETENT OF THE MECHANICAL BIAS

from inside and bend over. As the initial tension of the film rollers is lost when replacing the transport band, the film must also be inserted again in accordance with the instructions.

Taking Down the Film

1. Either the film cassette is accessible from the front of the unit or the unscrewing of only a partial front name plate or front name plate is required.
2. Turn film drive, if possible, as far as the left-hand stop (beginning of scale), failing this, roll the film by hand on to the left-hand roller after taking down the film cassette. (point 4).
3. Slacken fixing screws (A) of the film guide and pull out the film guide towards the front (Fig. 1).
4. Wind film completely on to roller C and detach adhesive strip from roller D (Fig. 3).
5. Unwind film from roller C and detach adhesive strip from roller C.Carefully remove any residue of adhesive from the rollers.

Inserting the New Film

The spare film must be rolled in such a manner that the lettering for the high frequencies is legible from the outside. Remove dust particles from the film guide with a soft brush, the proceed as follows:

6. Grasp roller C, turn sprocket roller E four turns counter-clockwise (the equalizing spring in roller C is tensioned during the process) and lock in this position by tightening the set screw F with an hexagon socket spanner 1.5 DIN 911, Fig. 4.
7. Stick adhesive strip (40 mm x 19 mm), e.g. "Tesafilm" adhesive strip, order No. 5859, Messrs. Beiersdorf, Hamburg, on to the legible end of the film in such a manner that 20 mm are left projecting (Fig. 2).

8. Stick end of film on to roller C (Fig. 2). The edge of the film must be parallel with the edge of the roller after glueing.

9. Roll film tightly on to roller C (Fig. 3) and grip until point 11 has been carried out.

10. Slip end of film (beginning of scale) only as far through the bearing support and stiffening piece until it can be taughtly glued on to the roller D.

11. Stick film on to roller D as described under points 7 and 8 (Fig. 3).

12. Slacken set screw F (Fig. 4). Spring tension must now be felt. If roller C is gripped and sprocket roller E given a quarter turn anticlockwise, the sprocket roller must return to its initial position when being released.

13. Turn one of the sprocket rollers until the first unlettered scale mark coincides exactly with the graduation mark in the scale window. (This mark designates the mechanical stop of the film drive).

14. The film drive must be at the left-hand end stop.

15. Insert film guide carefully without exerting pressure and note whether the film perforations drop into the sprocket.

16. Uniformly tighten the three fixing screws (A) of the film guide.

17. Verify for a second time that the film has been inserted correctly by checking the frequency calibration.

5. S T Ü C K L I S T E

Vorbemerkung

Unter Symbol stehen die in den Stromläufen verwendeten Abkürzungen für die Bauteile in alphabetischer und - soweit möglich - in numerischer Reihenfolge. Mit Stück ist die Anzahl der gleichen Bauteile innerhalb der Geräte oder der Baugruppe bezeichnet. In der Spalte Gegenstand sind ausser dem Namen des Bauteils auch seine Hauptkennwerte angegeben. Mit der Bestellnummer ist das Bauteil durch einen Abkürzungs-Code oder eine Bauvorschrift eindeutig gekennzeichnet.

Es bedeuten:

bei einem Widerstand: 300 kΩ ±5 %; 0,5 W
- 300 kΩ . . . . . Nennwert des Widerstandes
- ±5 % . . . . . Toleranz des Nennwiderstandes
- 0,5 W . . . . . Belastbarkeit bezogen auf Umgebungstemperatur 20°C

bei einem Kondensator: 1000 pF ±20 %; 125 V-
- 1000 pF . . . . . Nennwert der Kapazität (1 pF = µµF = 10^{-12} F)
- ±20 % . . . . . Toleranz der Nennkapazität
- 125 V- . . . . . zulässige Betriebsgleichspannung

bei einem Übertrager:

Wicklg.I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	
228 µH ±2 %	720 Wdg HFL SS 60x0,03 35Ω
Abgriff(2a): 210 Wdg	1.Abgriff (gesw): 46 Wdg
	2.Abgriff (rtgn): 190 Wdg

Wicklg.I (1a,2a,3a)
- 440 Wdg . . . . . 440 Windungen, Anfang Lötöse 1a, Ende 3a;
- 0,1 CuL . . . . . aus Kupferdraht (Cu); 0,1 mm Ø; lackisoliert (L)
- 75 Ω . . . . . Gleichstromwiderstand der Wicklung I
- 228 µH . . . . . Induktivität
- Abgriff(2a): 210 Wdg . . Abgriff bei der 210.Windung, Lötöse 2a

Wicklg.II — sinngemäss wie bei Wicklung I
- HFL SS 60x0,03 . . . . . Hochfrequenzlitze 2fach seidenumsponnen (SS), aus Kupferdraht 60x0,03 mmØ

bei einem Gleichrichter: 50 V/250 mA
- 50 V . . . . . Anschluss-Wechselspannung
- 250 mA . . . . . entnehmbarer Betriebsstrom

+ Farbkurzzeichen

bl = blau	ge = gelb	gr = grau	sw = schwarz	rs = rosa
br = braun	gn = grün	rt = rot	ws = weiss	rtsw = rot/schwarz

5. PARTS LIST

Introductory remark

The "SYMBOL" column shows the abbreviations used in the circuit diagrams in alphabetic and, to the extent possible, numerical order. "QTY" denotes the number of identical components within the devices or the subassembly. The "DESCRIPTION" column gives, apart from the designation of the components, its principal characteristic data. The "ORDER NUMBER" column designates the component nonambiguously by an abbreviation code or a component specification.

There denotes, for instance

with a resistor:	300 kΩ ±5%; 0,5 W
300 kΩ	Nominal value of the resistance
±5%	Tolerance of the nominal resistance
0,5 W	Wattage rating, as referred to an ambient temperature of 20°C
with a capacitor:	1000 pF ±20%; 125 V-
1000 pF	Nominal value of the capacitance (1 pF = 1 µµF = 10^{-12} F)
±20%	Tolerance of the nominal capacitance
125 V-	Permissible DC operating voltage

with a transformer:	Wicklg. I(1a,2a,3a)	Wicklg. II(rtsw,gesw, rtgn,gegnsw)+
	440 Wdg 0,1 CuL 75 Ω	720 Wdg HFL SS 60x0,03 35 Ω
	228 µH ±2%	1.Abgriff(gesw): 46 Wdg
	Abgriff(2a): 210 Wdg	2.Abgriff(rtgn): 190 Wdg

Wicklg.I(1a,2a,3a)	
440 Wdg	440 turns, start soldering lug 1a, end 3a
0,1 CuL	of copper wire (Cu); 0.1 mm dia., enamelled (L)
75 Ω	DC resistance of winding I
228 µH	Inductance
Abgriff(2a):210Wdg	Tap at soldering lug 2a at the 210th turn
Wicklg. II . . .	Analogously to winding I
HFL SS 60x0,03 .	RF copper Litz wire, with double silk covering, 60x0.03 mm dia.
with a rectifier:	50 V/250 mA
50 V	Primary AC voltage
250 mA	Available operating current

+Color symbols

bl = blue ge = yellow gr = gray sw = black rs = pink
br = brown gn = green rt = red ws = white rtsw = red/black

Pegelmesser 1o kHz - 17 MHz S45o34-D2oo6-B1o2,B2o4,C1o2,C2o4
LEVEL METER 1o kHz - 17 MHz

Ausführung -D2oo6-B1o2: dB-Eichung, MODEL dB-CALIBRATION
Ausführung -D2oo6-B2o4: dBm-Eichung,MODEL dBm-CALIBRATION
Ausführung -D2oo6-C1o2: dB-Eichung, MODEL dB-CALIBRATION
Ausführung -D2oo6-C2o4: dBm-Eichung, MODEL dBm-CALIBRATION

Symbol SYMBOL	Stck QTY	für Ausfg. FOR MODEL B1o2	B2o4	C1o2	C2o4	Gegenstand DESCRIPTION	Bestellangabe ORDERING DATA	Seite PAGE
	1	1	1	1		Oszillator f1 OSCILLATOR f1	S45o35-D5122-A7o1	5.3
	1	1	1	1		Osz./Teiler/Phasmod. OSC/DIVIDER/PHASE MOD	S45o35-D5125-A7o1	5.4
	1	1	1	1		Filter/Verstärker FILTER/AMPLIFIER	S45o35-D5126-A7o1	5.5
	1	1	1	1		Oszillator f2 OSCILLATOR f2	S45o35-D5129-A7o1	5.5
	1	1	1	1		Oszillator/Modulator OSCILLATOR/MODULATOR	S45o35-D5132-B7o1	5.6
	1	1	1	1		Phasmod./Suchosz. PHASE MOD/SEARCH FREQ OSC	S45o35-D5133-A7o1	5.6
	1	1	1	1		Modulator 1 MODULATOR 1	S45o35-D5135-A7o1	5.7
	1	1	1	1		Modulator 2 MODULATOR 2	S45o35-D5136-A7o1	5.7
	1	1	1	1		Modulator 3 MODULATOR 3	S45o35-D5137-A7o1	5.8
	1	1	1	1		1oo-kHz-Quarz-Bandpaß 1oo-kHz-CRYSTAL-FILTER	S45o35-D5138-B7o1	5.8
	1	1	1	1		1oo-kHz-Spulen-Bandpaß 1oo-kHz-COIL-FILTER	S45o35-D5139-A7o1	5.9
	1	1	1	1		1oo-kHz-Vorverstärker 1oo-kHz-PREAMPLIFIER	S45o35-D5140-A7o1	5.9
	1	1	1	1		1oo-kHz-Endverstärker 1oo-kHz-TERMINAL AMPLIFIER	S45o35-D5141-A7o1	5.9
	1	1				Ausgangsteil OUTPUT SECTION	S45o35-D5142-A1o1	5.9
	1		1	1		Ausgangsteil OUTPUT SECTION	S45o35-D5142-A2o1	5.9
	1	1	1	1		Netzteil POWER SUPPLY UNIT	S45o35-D5143-B7o1	5.1o
	1	1	1	1		Grundplatte 1 BASE BOARD 1	S45o35-D5144-A7o1	5.1o
	1	1	1	1		Grundplatte 2 BASE BOARD 2	S45o35-D5145-A7o1	5.1o
	1	1	1	1		Wandler DC/DC INVERTER	S45o35-D5148-B7o1	5.1o
	1	1	1	1		Eichleitung VARIABLE ATTENUATOR	S45o34-D2o52-B7o1	5.1o
						Schichtwiderstand LAYER-TYPE RESISTOR		
R1	1	1	1	1		2,2 kOhm±2%; o,25 W	B51263-A2222-G	
R2	1	1	1	1		2,5 kOhm±1%; o,1 W	B51263-A9252-F	
R3,4	2	2	2	2		82o Ohm ±5%; o,15 W	B51262-A2821-J	
						Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR		
P1	1	1	1	1		1 kOhm±2o%; lin	W4o954-B81o2-Moo1	
P2	1	1	1	1		1o kOhm±2o%; lin	W4o1o1-B81o3-Moo1	
P3	1	1	1	1		1o kOhm±2o%; lin	W4o1o2-B81o3-Moo1	
P4	1	1	1	1		5oo Ohm±3o%; lin	W4o1o2-H85o1-Moo1	
C2	1	1	1	1		Styroflex-Kond. STYROFLEX CAPACITOR 2o pF±1%; 16o V	B31861-A12oo-F	
C3	1	1	1	1		Tantal-Elko TANTAL ELECTROLYTIC CAP 47 µF ±2o%; 35 V	B4517o-A4476-M	
C4	1	1	1	1		MKL-Kondensator MKL-CAPACITOR 1 µF ±2o%; 63 V	B3211o-E91o5-M	
C1	1	1	1	1		Lufttrimmer AIR-DIELECTRIC TRIMMER 1,7...19 pF	C4o2o8-Z13o-A26	
Gr1,2	2	2	2	2		Diode DIODE	BAY 41	
I	1	1	1	1		Tubusinstrument MOVING-COIL INSTRUMENT 1oo µA; lin	V7o349-A578-A7	
A1,2	2	2	2	2		Relais RELAY	V23162-Ao721-B1o4	
S3	1	1	1	1		Schalter SWITCH	C44315-A14-A23	
S4	1	1	1	1		Schalter SWITCH	C42315-A17-A3o	
S5	1	1	1	1		Schalter SWITCH	C22315-Z1-C8	
S2	1	1	1	1		Leuchtdrehtaste LIGHTED TURNSWITCH	V3o188-X899-X-1	
Lp1,2	2	2	2	2		Signallampe INDICATING LAMP	24 V/25mA	
	1	1	1	1		Drehknopf f.P TURNING KNOB FOR P1	C44106-A2o-A2	
	1	1	1			Knebelgriff f.S1 KNOB FOR S1	H6o5o2-A631-A1	
	1	1	1	1		Deckel COVER	H6o5o2-F31-G	
	1	1	1	1		Knebelgriff f.S3 KNOB FOR S3	H6o5o2-A623-A1	
	1	1	1	1		Deckel	H6o5o2-F23-G	
	2	2	2	2		Drehknopf m.Kurbel TURNING KNOB WITH HANDLE	C44106-A2o-A3	
	2	2	2	2		Drehknopf TURNING KNOB	C44106-A2o-A5	
	1	1	1	1		Netzanschlußleitung POWER CORD	V45594-F4-A222	
	1	1	1	1		Batterieanschlußltg. BATTERY CONNECTING CORD	V45257-R3oo3	

Oszillator f1 S45035-D5122-A701
OSCILLATOR f1

	1	Oszillator 1 OSCILLATOR 1	S45035-D5123-A701
	1	Trennverstärker 1 BUFFER AMPLIFIER	S45035-D5124-A701
	1	Siebplatte FILTER BOARD	S45035-D5127-A701
	1	Filmskalenantrieb FILM-SCALE DRIVE	C44106-A7-A4
	1	Membrankupplung MEMBRANE JOINT	C44106-A5-A86
R31	1	Schichtwiderstand LAYER-TYPE RESISTOR 3,3 kOhm ±5%; 0,15 W	B51262-A2332-J
L7	1	Ringkernspule TOROIDAL CORE COIL	V45237-K3004
C9,24,36	3	Duko LEAD-THROUGH CAPACITOR 2500 pF +30-20%; 500V	B37481-B5252-B000
C13	1	Drehkondensator VAR CAPACITOR	V45246-Z3004-A1

Oszillator 1 S45035-D5123-A701
OSCILLATOR 1

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,4	2	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R2	1	18 Ohm ±5%; 0,15 W	B51262-A2180-J
R3,12	2	1,2kOhm ±5%; 0,15 W	B51262-A2122-J
R5,15	2	27 Ohm ±5%; 0,15 W	B51262-A2270-J
R6,7	2	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R8	1	33 kOhm ±5%; 0,15 W	B51262-A2333-J
R9	1	47 Ohm ±5%; 0,15 W	B51262-A2470-J
R10,14	2	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R11	1	220 Ohm ±5%; 0,15 W	B51262-A2221-J
R13	1	68 Ohm ±5%; 0,15 W	B51262-A2680-J
R16	1	3,3kOhm ±5%; 0,15 W	B51262-A2332-J
R17	1	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R18	1	47 kOhm ±5%; 0,15 W	B51262-A2473-J
R19	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R21,22	2	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R20	1	Drehwiderstand VAR RESISTOR 5 kOhm lin 0,5 W	C44408-Z4-C9
Ü1	1	Übertrager TRANSFORMER	V45237-L3010
L1	1	Keramik-Spule CERAMIC COIL 0,407 µH ±3%	C44330-Z1-C2
L2,3	2	HF-Drossel RF-CHOKE 47 µH	V44233-Z3oo2
		Keramik-Kondensator CERAMIC CAPACITOR	
C1,2 17,23	4	3300 pF +30/-20%; 500V	B37632-B5332-B003
C3	1	47 pF ±1%; NPO 500V	B38242-A5470-F003
C4,5	2	120pF ±1%; NPO 500V	B38222-S5121-F1
C6	1	15 pF ±5%; NPO 500V	B38472-A5150-J3
C8	1	6 pF ±0,5pF; NPO 500V	B38222-A5060-D003
C10	1	56 pF ±1%; NPO 500V	B38242-A5560-F003
C11	1	200pF ±2%; N150 500V	B38222-S52o1-J1
C12	1	200pF ±1%; NPO 500V	B38222-S52o1-F1
C14	1	2 pF ±0,5pF; N750 500V	B38266-J5o2o-D
C16	1	3 pF ±1%; NPO 500V	B38222-A5030-F003
C18,22	2	2000pF +30/-20%; 500V	B37638-B5202-B003
C19,20, 21	3	2200pF +30/-20%; 500V	B37643-B5222-B003
C15	1	Thermo-Trimmer THERMO TRIMMER 2,5 pF	V45246-Z3003

Ts1,2,3	3	Transistor TRANSISTOR	2 N 918
Ts4	1	Transistor TRANSISTOR	BCY 58 IX
Gr1,2	2	Germaniumdiode GERMANIUM DIODE	OA 90
Gr3	1	Kapazitätsdiode VARACTOR	BA 111

Trennverstärker 1 S45035-D5124-A701
BUFFER AMPLIFIER 1

		Schichtwiderstand LAYER-TYPE RESISTOR	
R30	1	75 Ohm ±5%; 0,15 W	B51262-A2750-J
R31,32 45,46	4	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R33,37 47,51	4	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R34,48	2	47 Ohm ±5%; 0,15 W	B51262-A2470-J
R35,36, 49,50	4	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R38,52	2	56 Ohm ±5%; 0,15 W	B51262-A2560-J
R39,53	2	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R40,56	2	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R41,54	2	27 Ohm ±5%; 0,15 W	B51262-A2270-J
R42,55	2	3,3kOhm ±5%; 0,15 W	B51262-A2332-J
Ü2,3	2	Übertrager TRANSFORMER	V45237-L3010
L6	1	HF-Drossel RF CHOKE 39 /uH	C44330-Z5-C2
		Keramik-Kondensator CERAMIC CAPACITOR	
C30,32, 33,38, 40,41	6	2000pF +30/-20%; 500V	B37638-B5202-R003
C34,37, 42	3	4700pF +50/-20%; 500V	B37332-B5472-S00
Ts5,6, 7,8	4	Transistor TRANSISTOR	2 N 918

Osz./Teiler/Phasmod. S45035-D5125-A701
OSC./DIVIDER/PHASE MODULATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,8, 42	3	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R2,10, 27,30,56	5	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R3	1	33 kOhm ±5%; 0,15 W	B51262-A2333-J
R4	1	5,6kOhm ±5%; 0,15 W	B51262-A2562-J
R5	1	180 Ohm ±5%; 0,15 W	B51262-A2181-J
R6,15, 16,49	4	2,2kOhm ±5%; 0,15 W	B51262-A2222-J
R7	1	6,8kOhm ±5%; 0,15 W	B51262-A2682-J
R9,14	2	560 Ohm ±5%; 0,15 W	B51262-A2561-J
R11	1	390 Ohm ±5%; 0,15 W	B51262-A2391-J
R13	1	47 Ohm ±5%; 0,15 W	B51262-A2470-J
R17,45	2	300 Ohm ±5%; 0,15 W	B51262-A2301-J
R18	1	600 Ohm ±5%; 0,15 W	B51262-A2601-J
R19,21, 32,33,38	5	220 Ohm ±5%; 0,15 W	B51262-A2221-J
R22,43, 55	3	3,3kOhm ±5%; 0,15 W	B51262-A2332-J
R23	1	12 kOhm ±5%; 0,15 W	B51262-A2123-J
R24	1	22 kOhm ±5%; 0,15 W	B51262-A2223-J
R25,47	2	82 Ohm ±5%; 0,15 W	B51262-A2820-J
R26,48	2	2,7kOhm ±5%; 0,15 W	B51262-A2272-J
R28	1	39 kOhm ±5%; 0,15 W	B51262-A2393-J
R29,36, 37	3	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R31	1	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R34	1	820 Ohm ±5%; 0,15 W	B51262-A2821-J
R35	1	47 kOhm ±5%; 0,15 W	B51262-A2473-J
R39,41	2	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R44	1	18 Ohm ±5%; 0,15 W	B51262-A2180-J
R46	1	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R51	1	150 Ohm ±5%; 0,15 W	B51262-A2151-J
R52	1	180 Ohm ±5%; 0,15 W	B51262-A2181-J
R53,54	2	68 Ohm ±5%; 0,15 W	B51262-A2680-J
R57	1	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R58	1	150kOhm ±5%; 0,15 W	B51262-A2154-J
R59	1	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R12	1	Drehwiderstand VAR RESISTOR 100 Ohm lin	C44408-Z4-C4

		Übertrager TRANSFORMER	
Ü1	1		V45231-F3025
Ü2	1		V45231-F3026
Ü3	1		V45231-F3027
Ü4	1		V45237-L3010
		HF-Drossel RF CHOKE	
L1,2,6	3	39 /uH	C44330-Z5-C2
L3,4,5	3	100/uH	C44330-Z5-C9
C1,3	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 2,2 /uF ±20%; 20V	B45170-A3225-M
C2	1	Styroflexkondensator STYROFLEX CAPACITOR 900 pF ±2%; 63V	B31662-A5901-C
C5	1	Keramik-Kondensator CERAMIC CAPACITOR 12 pF ±5%; NP0 500V	B38222-A5120-J003
C6,24	2	MKM-Kondensator MKM-CAPACITOR 0,01 /uF ±20 %; 160V	B32435-A2103-M
C7	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 4,7/uF ±20%; 10V	B45170-A1475-M
C8	1	Keramik-Kondensator CERAMIC CAPACITOR 150 pF ±5%; N330 500V	B38224-J5151-J003
C9	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 10 /uF ±20%; 10V	B45170-A1106-M
C11,12, 17	3	MKM-Kondensator MKM-CAPACITOR 0,022/uF ±20%; 160V	B32435-A2223-M
C13,14,	2	MKM-Kondensator MKM-CAPACITOR 0,15 /uF ±20%; 160V	B32435-A2154-M
C15	1	Styroflex-Kondensator STYROFLEX CAPACITOR 600 pF ±2%; 160V	B31861-A1601-C
		Tantal-Elko TANTAL ELECTROLYTIC CAP	
C16	1	2,2 /uF ±20%; 20V	B45170-A3225-M
C18,28	2	4,7 /uF ±20%; 10V	B45170-A1475-M
C19	1	MKL-Kondensator MKL CAPACITOR 0,15/uF±20%; 63 V	B32110-E9154-M
C21	1	Styroflex-Kondensator STYROFLEX CAPACITOR 2000pF ±2%; 160V	~~B31861-A1202~~-C
		Keramik-Kondensator CERAMIC-CAPACITOR	
C22,25	2	470 pF +30/-20%; 500V	B37635-B5471-R003
C26,27, 31,32,33	5	1600pF +30/-20%; 500V	B37638-B5162-R003
C29	1	100 pF ±5%; N750 500V	B38226-J5101-J003
C34	1	MKM-Kondensator MKM-CAPACITOR 0,047 /uF ±20%; 160V	B32435-A2473-M
C35	1	Keramik-Kondensator CERAMIC CAPACITOR 22 pF ±5%; NP0 500V	B38222-A5220-J003
C4	1	Luft-Trimmer AIR DIELECTRIC TRIMMER 1,9....11pF	C40208-Z131-A6
		Transistor TRANSISTOR	
Ts1...8	8		BCY 58 VIII
Ts9,10, 11,13	4		2 N 918
Ts12	1		2 N 3546
IC1,2	2	Dek.Teiler DEC DIVIDER	SN 7490
IC3,4,5,6	1	J-K-Flip-Flop J-K FLIP-FLOP	MC 2o26 P
Gr1	1	Silizium-Diode SILICON DIODE	HPA 5082-2800
Gr2	1	Zenerdiode ZENER DIODE ZF 6,8	V42292-H27-A
Gr3,4	2	Germaniumdiode GERMANIUM DIODE	OA 90
Gr5	1	Hot-Carrier-Diode HOT CARRIER DIODE	HP 2900
Gr6	1	Diode DIODE	ITT 700
Gr7	1	Kapazitätsdiode VARACTOR	BA 141
Kr1	1	Quarz CRYSTAL 1000,00 Hz, Q36	Q83638-A1000-H

Filter/Verstärker S45035-D5126-A701
FILTER/AMPLIFIER

Schichtwiderstand
LAYER-TYPE RESISTOR

R1	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R2	1	27 kOhm ±5%; 0,15 W	B51262-A2273-J
R3	1	6,2kOhm ±5%; 0,15 W	B51262-A2622-J
R4	1	3 kOhm ±5%; 0,15 W	B51262-A2302-J
R5	1	910 Ohm ±5%; 0,15 W	B51262-A2911-J
R6,40	2	680 Ohm ±5%; 0,15 W	B51262-A2681-J
R7	1	300 Ohm ±5%; 0,15 W	B51262-A2301-J
R8	1	82 kOhm ±5%; 0,15 W	B51262-A2823-J
R9,17	2	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R10	1	4,3kOhm ±5%; 0,15 W	B51262-A2432-J
R11,31	2	82 Ohm ±5%; 0,15 W	B51262-A2820-J
R12,13,30	3	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R14	1	820 Ohm ±5%; 0,15 W	B51262-A2821-J
R15	1	22 kOhm ±5%; 0,15 W	B51262-A2223-J
R16,27	2	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R18	1	43 Ohm ±5%; 0,15 W	B51262-A2430-J
R20,21	2	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R22	1	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R23,25	2	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R24	1	150 Ohm ±5%; 0,15 W	B51262-A2151-J
R26	1	56 Ohm ±5%; 0,15 W	B51262-A2560-J
R28	1	27 Ohm ±5%; 0,15 W	B51262-A2270-J
R29	1	3,3kOhm ±5%; 0,15 W	B51262-A2332-J
R35,38	2	3,68kOhm±1%; 0,1 W	B51263-A9362-F800
R36,37	2	920 Ohm ±1%; 0,1W W	B51263-A9921-F
R39	1	11 kOhm ±5%; 0,15 W	B51262-A2113-J
Ü1	1	Übertrager TRANSFORMER	V45237-L3010
L1	1	Spule COIL	V45231-F3031
L2	1	Spule COIL	V45231-F3032
L3	1	HF-Drossel RF CHOKE	C44330-Z5-C6

Styroflex-Kondensator
STYROFLEX CAPACITOR

C1	1	4240 pF ±2%; 160V	B31863-B1422-G400
C2	1	1190 pF ±2%; 160V	B31861-A1112-G900
C3	1	9540 pF ±2%; 160V	B31863-B1952-G400
C4	1	210 pF ±2%; 160V	B31861-A1211-G
C5	1	5300 pF ±2%; 160V	B31863-B1532-G
C6	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 3,3 µF ±20%; 15V	B45170-A2335-M
C7	1	MKM-Kondensator MKM-CAPACITOR 0,22 µF ±20%; 160V	B32435-A2224-M
C9	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C10	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 6,8 µF ±20%; 6V	B45170-A0685-M
C11,12	2	MKL-Kondensator MKL-CAPACITOR 0,47 µF ±20%; 63V	B32110-E9474-M
C13,16	2	Keramik-Kondensator CERAMIC CAPACITOR 470 pF +30/-20%; 500V	B37635-B5471-R003
C15,17	2	Keramik-Kondensator CERAMIC CAPACITOR 750pF+50/-20%; 500 V	B37636-B5752-R1
C19	1	Keramik-Kondensator CERAMIC CAPACITOR 1600 pF+30/-20%; 500V	B37638-B5162-R003
C21,23	2	Styroflex-Kondensator STYROFLEX CAPACITOR 5000 pF±2%; 160V	B31863-B1502-G
C22	1	Styroflex-Kondensator STYROFLEX CAPACITOR 10000pF±2%; 160V	B31863-B1103-G
C24	1	MKL-Kondensator MKL-CAPACITOR 1 µF ±20%; 63V	B32110-E9105-M
C25	1	MKM-Kondensator MKM-CAPACITOR 0,1 µF ±20%; 160V	B32435-A2104-M

Transistor
TRANSISTOR

Ts1,3,4	3		BCY 58 VIII
Ts2	1		BCY 58 IX
Ts5,6	2		2 N 918
Gr1	1	Zenerdiode ZENER DIODE ZF 10	V42292-H27-B
Gr2,3	2	Germaniumdiode GERMANIUM DIODE	OA 90

Siebplatte S45035-D5127-A701
FILTER BOARD

R80	1	Schichtwiderstand LAYER-TYPE RESISTOR 1,2kOhm ±5%; 0,15 W	B51262-A2122-J
R82	1	Schichtwiderstand LAYER-TYPE RESISTOR 1 kOhm ±5%; 0,15 W	B51262-A2102-J
R81	1	Drehwiderstand VAR RESISTOR 1 kOhm lin	C44408-Z4-C7
L4,5	2	HF-Drossel RF CHOKE 39 µH	C44330-Z5-C5
C61,62	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C63	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 4,7 µF ±20%; 10V	B45170-A1475-M
Gr3	1	Zenerdiode ZENER DIODE ZF 7,5	V42292-H26-C

Oszillator f2 S45035-D5129-A701
OSCILLATOR f2

	1	Oszillator 2 OSCILLATOR 2	S45035-D5130-A701
	1	Trennverstärker 2 BUFFER AMPLIFIER 2	S45035-D5131-A701
	1	Filmskalenantrieb FILM-SCALE DRIVE	C44106-A7-A4
	1	Membrankupplung MEMBRANE JOINT	C44106-A5-A86
C15	1	Duko LEAD-THROUGH CAPACITOR 2500 pF +30/-20%; 500V	B37481-B5252-R000
C16	1	Drehkondensator VAR CAPACITOR 11,5...171,5 pF	V45246-Z3004-A2

Oszillator 2 S45035-D5130-A701
OSCILLATOR 2

Schichtwiderstand
LAYER-TYPE RESISTOR

R1,3	2	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R2	1	150 Ohm ±5%; 0,15 W	B51262-A2151-J
R4	1	560 Ohm ±5%; 0,15 W	B51262-A2561-J
R5	1	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R6	1	2,7kOhm ±5%; 0,15 W	B51262-A2272-J
R7	1	16 kOhm ±5%; 0,15 W	B51262-A2163-J
Ü1	1	Übertrager TRANSFORMER	V45231-C3048

Keramik-Kondensator
CERAMIC CAPACITOR

C1	1	75 pF ±2%; N075 25 V	B38471-J5750-33
C2	1	68 pF±2%;N075 25V	B38471-J5680-33
C3	1	62 pF ±2%; N075 500V	B38471-J5620-33
C4	1	4 pF ±0,5pF;N750 500V	B38216-J5040-D003
C6,8	2	MKM-Kondensator MKM CAPACITOR 0,1 µF ±20%; 160V	B32435-A2104-M
C7	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 10 µF ±20%; 20V	B45170-A3106-M
C9	1	Keramik-Kondensator CERAMIC CAPACITOR .. pF ±0,5pF; N750 500V Wert wie eingebaut VALUE AS MOUNTED	B38226-J5...-D003
C5	1	Luft-Trimmer AIR DIELECTRIC TRIMMER 2,0...31 pF	C42208-Z130-A77
Ts1	1	Transistor TRANSISTOR	BCY 58 VIII
Gr1	1	Germaniumdiode GERMANIUM DIODE	OA 90
Gr2	1	Zenerdiode ZENER DIODE ZF 10	V42292-H27-B

Trennverstärker 2 S45035-D5131-A701
BUFFER AMPLIFIER 2

		Schichtwiderstand LAYER-TYPE RESISTOR	
R10	1	2,2kOhm ±5%; 0,15 W	B51262-A2222-J
R11,16	2	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R12	1	18 kOhm ±5%; 0,15 W	B51262-A2183-J
R13	1	62 kOhm ±5%; 0,15 W	B51262-A2623-J
R14	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R15	1	27 kOhm ±5%; 0,15 W	B51262-A2273-J
R17	1	150 Ohm ±5%; 0,15 W	B51262-A2151-J
R18	1	1,8kOhm ±5%; 0,15 W	B51262-A2182-J
R19	1	300 Ohm ±5%; 0,15 W	B51262-A2301-J
Ü3	1	Übertrager TRANSFORMER	V45231-F3017
C10,11,12,14	4	MKM-Kondensator MKM CAPACITOR 0,01 µF ±20%; 160V	B32435-A2103-M
C13	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 10 µF ±20%; 20V	B45170-A3106-M
Ts2,3	2	Transistor TRANSISTOR	BCY 58 VIII

Oszillator/Modulator S45035-D5132-B701
OSCILLATOR/MODULATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,35,36	3	8,2kOhm±5%; 0,15W	B51262-A2822-J
R2	1	82 Ohm ±5%; 0,15 W	B51262-A2820-J
R3,22	2	2,2kOhm ±5%; 0,15 W	B51262-A2222-J
R4	1	300 Ohm±5%; 0,15 W	B51262-A2301-J
R5,11,14,15,18,29,31	7	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R6,30	2	680 Ohm ±5%; 0,15 W	B51262-A2681-J
R7,8,9,10	4	150 Ohm ±5%; 0,15 W	B51262-A2151-J
R12,24	2	560 Ohm ±5%; 0,15 W	B51262-A2561-J
R13,15,18,29,37,38	6	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R16	1	1 kOhm ±5%; 0,15 W	B51262-A2102-J
R19,26	2	1,2kOhm ±5%; 0,15 W	B51262-A2122-J
R20	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R21,27	2	27 Ohm ±5%; 0,15 W	B51262-A2270-J
R25	1	150 Ohm ±2%; 0,15 W	B51262-A2151-G
R28	1	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R32	1	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R33	1	3,3kOhm ±5%; 0,15 W	B51262-A2332-J
R39	1	56 kOhm ±5%; 0,15 W	B51262-A2563-J
R40	1	82 kOhm ±5%; 0,15 W	B51262-A2823-J
		Übertrager TRANSFORMER	
Ü1	1		V45231-F3033
Ü2	1		V45231-F3034
Ü3	1		V45237-L3010
L1	1	UKW-Drossel VHF CHOKE 40 µH	B82501-A-C7
L2	1	Spule COIL	V45231-F3035
C1,9,14,18,36	5	Keramik-Kondensator CERAMIC CAPACITOR 1500 pF +30/-20%; 500V	B37638-B5152-R003
C4	1	Keramik-Kondensator CERAMIC CAPACITOR 33 pF ±1%; N075 500V	B38221-J5330-F003
C5	1	Styroflex-Kondensator STYROFLEX CAPACITOR 150 pF ±5%; 160V	B31861-A1151-J
C6,32,34	3	Keramik-Kondensator CERAMIC CAPACITOR 1000 pF +30/-20%; 500V	B37638-B5102-R003
C7,10,15,20,24,27	6	Duko LEAD-THROUGH CAPACITOR 1600 pF +100/-20%; 500V	B37046-A5162-Z002
		Keramik-Kondensator CERAMIC CAPACITOR	
C8	1	68 pF ±2%; NPO 500V	B38222-A5680-G003
C19,33	2	MKM-Kondensator MKM CAPACITOR 0,01 µF ±10%; 160V	B32435-A2103-K
		Keramik-Kondensator CERAMIC CAPACITOR	
C21	1	15 pF ±5%; NPO 500V	B38222-A5150-J003
C22	1	47 pF ±1%; NPO 500V	B38222-A5470-F003
C23	1	120pF ±1%; NPO 500V	B38222-A5121-F003
C26	1	1500pF+50-20%;500V	B37628-B5152-S003
C28	1	47 pF ±2%; N150 500V	B38222-J5470-G003
C29	1	80 pF ±1%; N075 500V	B38221-J5800-F003
C31	1	33 pF ±2 %;NPO 500V	B38222-A5330-G003
C35	1	27 pF ±5%; NPO 500V	B38222-A5270-J003
C3,30	2	Luft-Trimmer AIR-DIELECTRIC TRIMMER 1,9...11 pF	C40208-Z131-A6
Kr	1	Quarz CRYSTAL 22,1 MHz	QB2106-A2210-J
Ts1	1	Transistor TRANSISTOR	BFX 60
Ts2...7	6	Transistor TRANSISTOR	2 N 918
Gr1	1	Zenerdiode ZENER DIODE ZF 6,2	V42292-H26-A
Gr2	1	Siliziumdiode SILICON DIODE	HP 2800
Gr3,4,5,6	1	Diodenquartett DIODE QUARTET	V42292-E4-A1
Gr7	1	Kapazitätsdiode VARACTOR	BA 111
Gr8	1	Kapazitätsdiode VARACTOR	BA 141

Phasenmodulator/Suchoszillator S45035-D5133-A701
PHASE MOD/SEARCH FREQUENCY OSCILLATOR

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	20 kOhm ±5%; 0,15 W	B51262-A2203-J
R2	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R3	1	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R4	1	2,2kOhm ±5%; 0,15 W	B51262-A2222-J
R5,14	2	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R6,7,8	3	5,6kOhm ±5%; 0,15 W	B51262-A2562-J
R9	1	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R10	1	11 kOhm ±5%; 0,15 W	B51262-A2113-J
R11	1	2,7kOhm ±5%; 0,15 W	B51262-A2272-J
R13	1	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R15	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R16,25	2	820 Ohm ±5%; 0,15 W	B51262-A2821-J
R17	1	1 kOhm ±5%; 0,15 W	B51262-A2102-J
R18,19	2	3 kOhm ±5%; 0,15 W	B51262-A2302-J
R20	1	30 kOhm ±5%; 0,15 W	B51262-A2303-J
R21	1	9,1kOhm ±5%; 0,15 W	B51262-A2912-J
R23	1	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R24,27	2	680 Ohm ±5%; 0,15 W	B51262-A2681-J
R26	1	56 kOhm ±5%; 0,15 W	B51262-A2563-J
R30	1	390 Ohm ±5%; 0,15 W	B51262-A2391-J
R12	1	Thernewid THERNEWID THERMISTOR 200 Ohm ±5%1	Q63011-K201-J
R22	1	Thernewid THERNEWID THERMISTOR 1 kOhm ±5%;	Q63011-K102-J
Ü1	1	Übertrager TRANSFORMER	V45231-F3018
Ü2	1	Übertrager TRANSFORMER	V45231-F3016
L1,2	2	Spule COIL	V45231-F3019
C1	1	Styroflex-Kondensator STYROFLEX CAPACITOR 2000pF ±20%; 160V	B31861-A1202-M
C2	1	MKM-Kondensator MKM CAPACITOR 0,01 µF ±20%; 160V	B32435-A2103-M
C3,5	2	Styroflex-Kondensator STYROFLEX CAPACITOR 500 pF ±2%; 160V	B31861-A1501-G
C4	1	Styroflex-Kondensator STYROFLEX CAPACITOR 1000pF ±2%; 160V	B31861-A1102-G
C6,7	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 4,7 µF ±20%; 20V	B45170-A3475-M
C8	1	MKM-Kondensator MKM CAPACITOR 0,022 µF ±20%; 160V	B32435-A2223-M

C9	1	MKM-Kondensator MKM CAPACITOR 0,068 /uF ±20%; 160V	B32435-A2683-M
C10	1	MKL-Kondensator MKL CAPACITOR 0,33 /uF ±20%; 63V	B32110-E9334-M
C11,13	2	MKL-Kondensator MKL CAPACITOR 0,47 /uF ±20%; 63V	B32110-E9474-M
C12	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 4,7 /uF ±20%; 10V	B45170-A1475-M
C15	1	MKM-Kondensator MKM CAPACITOR 0,1 /uF ±20%; 160V	B32435-A2104-M
		Transistor TRANSISTOR	
Ts1...4	4		BCY 58 VIII
Ts5	1		BCY 58 X
Ts6	1		BCY 78 VII
Gr1,...4	4	Germaniumdiode GERMANIUM DIODE	OA 90

Modulator 1 S45035-D5135-A701
MODULATOR 1

		Schichtwiderstand LAYER-TYPE RESISTOR	
R2,44	2	5,6kOhm ±5%; 0,15 W	B51262-A2562-J
R3	1	2,7kOhm ±5%; 0,15 W	B51262-A2272-J
R4	1	300 Ohm ±5%; 0,15 W	B51262-A2301-J
R5,14, 17,33	4	51 Ohm ±5%; 0,15 W	B51262-A2510-J
R6,58	2	10 Ohm ±5%; 0,15 W	B51262-A2100-J
R7	1	Metallschichtwiderstand METAL LAYER-TYPE RESISTOR 185 Ohm ±1%; 0,25 W	B54412-A9181-F500
R8	1	Metallschichtwiderstand METAL LAYER-TYPE RESISTOR 6,8 Ohm ±5%; 0,25 W	B54412-A2060-J800
R9,41, 45	3	Schichtwiderstand LAYER-TYPE RESISTOR 100 Ohm ±5%; 0,15 W	B51262-A2101-J
R10	1	Schichtwiderstand LAYER-TYPE RESISTOR 15 Ohm ±5%; 0,15 W	B51262-A2150-J
R11	1	Metallschichtwiderstand METAL LAYER-TYPE RESISTOR 220 Ohm ±1%; 0,25 W	B54412-A9221-F
		Schichtwiderstand LAYER-TYPE RESISTOR	
R12	1	6,8kOhm ±5%; 0,15 W	B51262-A2682-J
R13	1	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R15,24, 25,26, 27,42	6	82 Ohm ±5%; 0,15 W	B51262-A2820-J
R16	1	39 Ohm ±5%; 0,15 W	B51262-A2390-J
R18	1	33 Ohm ±5%; 0,15 W	B51262-A2330-J
R19,32, 39,43	4	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R20	1	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R21,34, 38	3	47 Ohm ±5%; 0,15 W	B51262-A2470-J
R22,23	2	680 Ohm ±2%; 0,15 W	B51262-A2681-J
R28,29	2	220 Ohm ±2%; 0,15 W	B51262-A2221-G
R30	1	620 Ohm ±5%; 0,15 W	B51262-A2621-J
R31	1	7,5kOhm ±5%; 0,15 W	B51262-A2752-J
R35,52, 56	3	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R36,40	2	1,2kOhm ±5%; 0,15 W	B51262-A2122-J
R37,57	2	51 Ohm ±5%; 0,15 W	B51262-A2510-J
R46	1	300 Ohm ±5%; 0,15 W	B51262-A2301-J
R47,62	2	30 Ohm ±5%; 0,15 W	B51262-A2300-J
R48,54	2	390 Ohm ±5%; 0,15 W	B51262-A2391-J
R49	1	4,3kOhm ±5%; 0,15 W	B51262-A2432-J
R51	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R53	1	470 Ohm ±5%; 0,15 W	B51262-A2471-J
R55,59	2	680 Ohm ±5%; 0,15 W	B51262-A2681-J
R60	1	10 Ohm ±5%; 0,15 W	B51262-A2100-J
R61	1	75 Ohm ±5%; 0,15 W	B51262-A2750 J
R65	1	20 Ohm±5%; 0,15W	B51262-A2200-J
R50	1	Drehwiderstand VAR RESISTOR 1 kOhm lin	C44408-Z4-C7
Ü1	1	Übertrager TRANSFORMER	V45231-H3001-A2
Ü2	1	Übertrager	V45231-H3001-A1
Ü3	1	Übertrager TRANSFORMER	V45231-F3020
		Spule COIL	
L1	1		V45231-F3021
L2	1		V45231-F3022
L3	1		V45231-F3023
L4	1		V45231-F3024
L6	1	UKW-Drossel VHF CHOKE 10 /uH	B82501-A-C15
C1	1	MKM-Kondensator MKM CAPACITOR 0,22 /uF ±10%; 160V	B32435-A2224-K
C3	1	MKM-Kondensator MKM CAPACITOR 0,01 /uF ±10%; 160V	B32435-A2103-K
C4	1	Styroflex-Kondensator STYROFLEX CAPACITOR 31 pF ±1%; 160V	B31861-A1310-F
C5	1	Keramik-Kondensator CERAMIC CAPACITOR 3,1pF ±0,25pF; N150 500V	B38212-J5030-C103
C6	1	Styroflex-Kondensator STYROFLEX CAPACITOR 57,5pF ±1%; 160V	B31861-A1570-F500
C7	1	Keramik-Kondensator CERAMIC CAPACITOR 19,7pF ±2%; N075 500V	B38221-J5190-G703
C8,9	2	Styroflex-Kondensator STYROFLEX CAPACITOR 24 pF ±1pF; 160V	B31861-A1240-F
C10	1	Keramik-Kondensator CERAMIC CAPACITOR 26,2pF ±1%; N075 500V	B38221-J5260-F203
C11	1	Styroflex-Kondensator STYROFLEX CAPACITOR 49,5pF ±1pF; 160V	B31861-A1490-F500
C12	1	Keramik-Kondensator CERAMIC CAPACITOR 13,2pF ±2,5%; N075 500V	B38221-J5130-G203
C13	1	Styroflex-Kondensator STYROFLEX CAPACITOR 22 pF ±1pF; 160V	B31861-A1220-F
C14,17	2	MKM-Kondensator MKM CAPACITOR 0,1 /uF ±10%; 160V	B32435-A2104-K
C15,20, 23,45	4	Keramik-Kondensator CERAMIC CAPACITOR 1,5pF ±0,5pF; P100 500V	B38210-A5010-D503
C16	1	Keramik-Kondensator CERAMIC CAPACITOR 5,6pF ±1pF; N750 500V	B38216-J5050-F603
C18	1	MKL-Kondensator MKL CAPACITOR 4,7 /uF ±20%; 25 V	B32110-G3475-M
C19,22, 24,30, 31,32,33,39, 41,42,43,44	12	Keramik-Kondensator CERAMIC CAPACITOR 1500pF +30/-20%; 500V	B37638-B5152-R003
C21	1	Keramik-Kondensator CERAMIC CAPACITOR 47 pF ±1%; N075 500V	B38221-J5470-F203
C36	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 /uF ±20%; 20 V	B45170-A3156-M
C37	1	MKM-Kondensator MKM CAPACITOR 0,056 /uF ±10%; 160V	B32435-A2563-K
C38	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 47 /uF ±20%; 20V	B45170-A3476-M
C40	1	MKM-Kondensator MKM CAPACITOR 0,01 /uF ±10%; 160V	B32435-A2103-K
C2	1	Luft-Trimmer AIR-DIELECTRIC TRIMMER 1,3...5 pF	C40208-Z131-A5
Ts1...9	9	Transistor TRANSISTOR	2 N 918
Gr1...4	1	Diodenquartett DIODE QUARTET HP 2900	V42292-H25

Modulator 2 S45035-D5136-A701
MODULATOR 2

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	205 Ohm ±1%; 0,1 W	B51263-A9201-F500
R2	1	5,6kOhm ±1%; 0,1 W	B51263-A9562-F
R3	1	3,6kOhm ±1%; 0,1 W	B51263-A9362-F
R4	1	10 kOhm ±2%; 0,15 W	B51262-A2103-G
R5,8	2	51 Ohm ±5%; 0,15 W	B51262-A2510-J
R6,9	2	Metallschichtwiderstand METAL LAYER-TYPE RESISTOR 10 Ohm ±5%; 0,25 W	B54412-A2100-J
		Schichtwiderstand LAYER-TYPE RESISTOR	
R7	1	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R10	1	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R11	1	68 Ohm ±2%; 0,15 W	B51262-A2680-G

		Schichtwiderstand LAYER-TYPE RESISTOR	
R12,13, 14,15	4	750 Ohm ±2%; 0,15 W	B51262-A2751-G
R16	1	20 kOhm ±5%; 0,15 W	B51262-A2203-J
R17	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R18,25, 28	3	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R19	1	2 kOhm ±5%; 0,15 W	B51262-A2202-J
R20,21, 30	3	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R22	1	82 Ohm ±2%; 0,15 W	B51262-A2820-G
R23,29	2	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R24	1	3 kOhm ±5%; 0,15 W	B51262-A2302-J
R26	1	62 Ohm ±2%; 0,15 W	B51262-A2620-G
R27	1	240 Ohm ±5%; 0,15 W	B51262-A2241-J
		Übertrager TRANSFORMER	
Ü1	1		V45231-C3049
Ü2	1		V45231-C3050
Ü3	1		V45231-C3051
L1,2	2	Spule COIL	V45231-C3052
L3	1	UKW-Drossel VHF CHOKE 10 µH	B82501-A-C15
L4	1	HF-Drossel RF CHOKE 3,3 µH	C44330-Z5-C4
		Keramik-Kondensator CERAMIC CAPACITOR	
C1	1	93,5 pF ±1%; N075 500V	B38221-J5930-F503
C3	1	19,2 pF ±2 %; N075 500V	B38221-J5190-[illegible]503
C4	1	21,4 pF ±2%; N075 500V	B38221-J5210-G403
C6	1	18,3 pF ±2, %; N075 500V	B38221-J5180-[illegible]303
C7	1	20,5 pF ±2%; N075 500V	B38221-J5200-G503
C8,11, 17,19,20, 21,22,23	8	1500 pF +30/-20%; 500V	B37638-B5152-E003
C9,10	2	1,5 pF ±0,5pF; N033 500V	B38210-J5010-D503
C12	1	110 pF ±1%; N075 500V	B38221-J5111-F003
C13	1	70 pF ±1%; N075 500V	B38221-J5700-F003
C14	1	MKM-Kondensator MKM CAPACITOR 0,01 µF ±10%; 160V	B32435-A2103-K
C15	1	Keramik-Kondensator CERAMIC CAPACITOR 5,6 pF ±1pF; N075 500V	B38211-J5050-F603
C16,18	2	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A2104-K
C24	1	Duko LEAD-THROUGH CAPACITOR 2500pF +100/-20%; 500V	B37046-A5252-Z002
C2,5, 25	3	Luft-Trimmer AIR-DIELECTRIC TRIMMER 1,3...5 pF	C40208-Z131-A5
Ts1,2,4	3	Transistor TRANSISTOR	2 N 918
Ts3	1	Transistor TRANSISTOR	BCY 58 VIII
Gr1...4	4	Hot-Carrier-Diode HOT CARRIER DIODE	HP 2900

Modulator 3 S45035-D5137-A701
MODULATOR 3

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	390 Ohm ±1%; 0,1 W	B51263-A9391-F
R2	1	5,1kOhm ±5%; 0,15 W	B51262-A2512-J
R3	1	13 kOhm ±5%; 0,15 W	B51262-A2133-J
R4,14,24	3	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R5	1	3 kOhm ±5%; 0,15 W	B51262-A2302-J
R6...9	4	1 kOhm ±2%; 0,15 W	B51262-A2102-J
R10	1	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R11	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R12	1	2 kOhm ±1%; 0,1 W	B51263-A2202-F
R13	1	910 Ohm ±1%; 0,1 W	B51263-A2911-F
R15	1	2 kOhm ±5%; 0,15 W	B51262-A2202-J
R16,18, 23	3	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R17	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R19	1	15 kOhm ±5%; 0,15 W	B51262-A2153-J
R20	1	1 kOhm ±5%; 0,15 W	B51262-A2102-J
R21	1	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R22	1	220 Ohm ±5%; 0,15 W	B51262-A2221-J
Ü1	1	Übertrager TRANSFORMER	V45231-B3017
Ü2	1	Übertrager TRANSFORMER	V45231-B3018
L1,2	2	Spule COIL	V45231-B3019
L3	1	Spule COIL	V45231-B3020
C1	1	Styroflex-Kondensator STYROFLEX CAPACITOR 884 pF ±1%; 160V	B31861-A1881-F400
C2,5	2	Keramik-Kondensator CERAMIC CAPACITOR 180 pF ±1%; N033 500V	B38240-[illegible]
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C3	1	116 pF ±1%; 160V	B31861-A1111-F600
C4	1	846 pF ±1%; 160V	B31861-A1841-F600
C6	1	17 pF ±1%; 160V	B31861-A1170-F
C7	1	Keramik-Kondensator CERAMIC CAPACITOR 132 pF ±1%; N033 500V	B38240-[illegible]
C8,10,20	3	MKM-Kondensator MKM CAPACITOR 0,01 µF ±10%; 160V	B32435-A2103-K
C9	1	Keramik-Kondensator CERAMIC CAPACITOR 10 pF ±1%; N075 500V	B38211-J5100-F003
C11	1	Styroflex-Kondensator STYROFLEX CAPACITOR 3370pF ±1%; 160V	B31863-B1332-F700
C12,15, 22,23	4	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A2104-K
C13	1	Keramik-Kondensator CERAMIC CAPACITOR 20 pF ±10%; N075 500V	B38221-J5200-K003
C14	1	MKM-Kondensator MKM CAPACITOR 0,22 µF ±10%; 160V	B32435-A2224-K
C17	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C19	1	Keramik-Kondensator CERAMIC CAPACITOR 15 pF ±5%; N033 500V	B38220-J5150-J003
C21	1	Styroflex-Kondensator STYROFLEX CAPACITOR 220 pF ±1%; 160V	B31861-A1221-F
C18	1	Luft-Trimmer AIR-DIELECTRIC TRIMMER 1,9...11 pF	C40208-Z131-A6
Kr	1	Quarz CRYSTAL 2,3 MHz	Q82115-A2300-E
Ts1...4	4	Transistor TRANSISTOR	BCY 58 VIII
Gr1...4	4	Hot-Carrier-Diode HOT CARRIER DIODE	HP 2900
Gr5	1	Zenerdiode ZENER DIODE	ZF 6,8
Gr6	1	Zenerdiode ZENER DIODE ZF 8,2	V42292-H26-D
Gr7	1	Germaniumdiode GERMANIUM DIODE	OA 90

100-kHz-Quarz-Bandpaß S45035-D5138-B701
100-kHz-CRYSTAL BAND-PASS FILTER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	590 Ohm ±1%; 0,1 W	B51263-A9591-F
R2	1	390 Ohm ±5%; 0,15 W	B51262-A2391-J
R4	1	10 kOhm ±1%; 0,1 W	B51263-A9103-F
R5	1	9,1kOhm ±1%; 0,1 W	B51263-A9912-F
R6	1	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R7	1	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R8	1	1,8kOhm ±5%; 0,15 W	B51262-A2182-J
R9	1	Thernewid THERNEWID THERMISTOR 100kOhm ±10%	Q63011-K104-K
R3	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 2,2kOhmlin 0,7W	V44215-Z3004-A8
		Übertrager TRANSFORMER	
Ü1	1		V45231-C3181
Ü2	1		V45231-C3182
Ü3	1		V45231-C3183

		Styroflex-Kondensator STYROFLEX CAPACITOR	
C1,9	2	567 pF ±1%; 160V	B31861-A1561-F700
C3,5,8	3	58 pF ±1pF; 160V	B31861-A1580-F
C6	1	130 pF ±1%; 160V	B31861-A1131-F
C10,13	2	MKM-Kondensator MKM CAPACITOR 0,1 µF ±20%; 160V	B32435-A2104-M
C11	1	Keramik-Kondensator CERAMIC CAPACITOR 20 pF ±5%; N150 500V	B38222-J5200-J003
C12	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C2,4,7	3	Luft-Trimmer AIR-DIELECTRIC TRIMMER 1,7...19 pF	C40208-Z130-A76
Kr1,2,3	3	Quarz CRYSTAL 99,940 kHz	Q83402-A4994-F
Ts1	1	Transistor TRANSISTOR	BCY 58 VIII

100-kHz-Spulen-Bandpaß S45035-D5139-A701
100-kHz COIL BAND-PASS FILTER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,7	2	608 Ohm ±1%; 0,1 W	B51263-A9601-F800
R2	1	13 kOhm ±1%; 0,1 W	B51262-A9133-F
R3	1	10 kOhm ±1%; 0,1 W	B51263-A9103-F
R4	1	16 kOhm ±1%; 0,1 W	B51263-A9163-F
R5,12	2	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R6,13	2	2 kOhm ±5%; 0,15 W	B51262-A2202-J
R9	1	7 kOhm ±1%; 0,1 W	B51263-A9702-F
R11	1	8,2kOhm ±1%; 0,1 W	B51263-A9822-F
R14,15	2	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R8,16	2	Thernewid THERNEWID THERMISTOR 20 kOhm ±10%	Q63011-K203-K
R10	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 2,2kOhm ±20%; lin 0,7W	V44215-Z3000-A5
		Übertrager TRANSFORMER	
Ü1,4	2		V45231-C3053
Ü2,5	2		V45231-C3054
Ü3,6	2		V45231-C3055
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C1,9	2	4920 pF ±1%; 160V	B31863-B1452-F200
C2,10	2	146 pF ±1%; 160V	B31861-A1141-F600
C3,11	2	4800 pF ±1%; 160V	B31863-B1482-F
C4,12	2	122 pF ±1%; 160V	B31861-A1121-F200
C5,13	2	4940 pF ±1%; 160V	B31863-B1492-F400
C6,8, 14,16	4	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A21 4-K
C7,15	2	Keramik-Kondensator CERAMIC CAPACITOR 20 pF ±10%; N075 500V	B38221-J5200-K003
C17,18	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
Ts1,2	2	Transistor TRANSISTOR	BCY 58 VIII

100-kHz-Vorverstärker S45035-D5140-A701
100-kHz-PREAMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	5,6kOhm ±5%; 0,15 W	B51262-A2562-J
R2	1	18 kOhm ±5%; 0,15 W	B51262-A2183-J
R3	1	3,9kOhm ±5%; 0,15 W	B51262-A2392-J
R4	1	3,6kOhm ±5%; 0,15 W	B51262-A2362-J
R5	1	100 Ohm ±1%; 0,1 W	B51263-A9101-F
R6	1	680 Ohm ±5%; 0,15 W	B51262-A2681-J
R7,9, 11,12,16	5	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R8	1	8,2kOhm ±5%; 0,15 W	B51262-A2822-J
R10,17	2	2 kOhm ±5%; 0,15 W	B51262-A2202-J
R13,14	2	56 kOhm ±5%; 0,15 W	B51262-A2563-J
C1,2,10	3	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A2104-K
C3,6	2	MKM-Kondensator MKM CAPACITOR 0,22 µF ±10%; 160V	B32435-A2224-K
C4,9,11	3	Keramik-Kondensator CERAMIC CAPACITOR 10 pF ±0,5pF; P100 500V	B38220-A5100-D003
C5,8	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C7	1	MKM-Kondensator MKM CAPACITOR 0,01 µF ±10%; 160V	B32435-A2103-K
Ts1...4	4	Transistor TRANSISTOR	BCY 58 VIII
Gr1	1	Zenerdiode ZENER DIODE	ZF 6,8

100-kHz-Endverstärker S45035-D5141-A701
100-kHz-TERMINAL AMPLIFIER

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	6,8kOhm ±5%; 0,15 W	B51262-A2682-J
R2	1	9,1kOhm ±5%; 0,15 W	B51262-A2912-J
R3,8	2	3 kOhm ±5%; 0,15 W	B51262-A2302-J
R4	1	2,4kOhm ±1%; 0,1 W	B51263-A9242-F
R5	1	80 Ohm ±1%; 0,1 W	B51263-A9800-F
R6	1	1 kOhm ±5%; 0,15 W	B51262-A2102-J
R7,14	2	200 Ohm ±5%; 0,15 W	B51262-A2201-J
R9	1	4,7kOhm ±5%; 0,15 W	B51262-A2472-J
R10	1	11 kOhm ±5%; 0,15 W	B51262-A2113-J
R11	1	2,2kOhm ±1%; 0,1 W	B51263-A9222-F
R12,16	2	100 Ohm ±1%; 0,1 W	B51263-A9101-F
R13	1	330 Ohm ±5%; 0,15 W	B51262-A2331-J
R15	1	390 Ohm ±5%; 0,15 W	B51262-A2391-J
R17	1	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R18	1	Schichtwiderstand LAYER-TYPE RESISTOR 56 Ohm ±5%; 0,15 W	B51262-A2560-J
R19	1	Thernewid THERNEWID THERMISTOR 2 kOhm ±10%	Q63011-K202-K
Ü1	1	Übertrager TRANSFORMER	V45231-C3056
C1,11	2	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A2104-K
C2,5	2	MKM-Kondensator MKM CAPACITOR 0,01 µF ±10%; 160V	B32435-A2103-K
C3	1	Keramik-Kondensator CERAMIC CAPACITOR 20 pF ±10%; NPO 500V	B38222-A5200-K001
C4,9	2	MKM-Kondensator MKM CAPACITOR 0,27 µF ±10%; 160V	B32435-A2274-K
C6	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
C7	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 47 µF ±20%; 20V	B45170-A3476-M
C8	1	Keramik-Kondensator CERAMIC CAPACITOR 10 pF ±0,5pF; N150 500V	B38222-A5100-D003
C10	1	MKM-Kondensator MKM CAPACITOR 0,33 µF ±10%; 160V	B32435-A2334-K
C12	1	Styroflex-Kondensator STYROFLEX CAPACITOR 9270 pF ±1%; 160V	B31863-B1922-F700
Ts1...4	4	Transistor TRANSISTOR	BCY 58 VIII
Gr1	1	Zenerdiode ZENER DIODE	ZF 6,8

Ausgangsteil S45035-D5142-A701
OUTPUT SECTION

		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,2	2	1 kOhm ±5%; 0,15 W	B51262-A2102-J

R3	1	8,2kOhm ±2%; 0,15 W	B51262-A2822-G
R4	1	5,6kOhm ±5%; 0,15 W	B51262-A2562-J
R6	1	6,8kOhm ±2%; 0,15 W	B51262-A2682-J
R7	1	7,5kOhm ±2%; 0,15 W	B51262-A2752-J
R10	1	...kOhm ±2%; 0,15 W Wert wie eingebaut VALUE AS MOUNTED	B51262-A2...-G
R11	1	22 kOhm ±5%; 0,15 W	B51262-A2223-J
R12	1	750 Ohm ±2%; 0,15 W	B51262-A2751-G
R13	1	10 kOhm ±2%; 0,15 W	B51262-A2103-G
R14	1	200 Ohm ±2%; 0,15 W	B51262-A2201-G
R15	1	62 kOhm ±5%; 0,15 W	B51262-A2623-J
R16	1	12 kOhm ±2%; 0,15 W	B51262-A2123-G
R17	1	3,3kOhm ±2%; 0,15 W	B51262-A2332-G
R18	1	820 Ohm ±2%; 0,15 W	B51262-A2821-G
R19,21	2	100 Ohm ±5%; 0,15 W	B51262-A2101-J
R20	1	1,5kOhm ±5%; 0,15 W	B51262-A2152-J
R22	1	600 Ohm ±2%; 0,15 W	B51262-A2601-G
R23	1	10 kOhm ±5%; 0,15 W	B51262-A2103-J
R24	1	2 kOhm ±5%; 0,15 W	B51262-A2202-J
R25	1	470 Ohm ±5%; 0,15 W	B51262-A2471-J
R26	1	300 Ohm ±5%; 0,15 W	B51262-A2301-J
R29,30	2	...kOhm ±2%; 0,15 W Wert wie eingebaut VALUE AS MOUNTED	B51262-A2...-G
R31	1	33 Ohm ±1%; 0,15 W	B51262-A2330-J
R32	1	10 Ohm ±5%; 0,15 W	B51262-A2100-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R5	1	2,2kOhm ±20%; 0,5W,lin	V44215-Z3000-A5
R7,9	2	4,7kOhm ±20%; 0,5W,lin	V44215-Z3000-A9
R27,28	2	220 Ohm ±20%; 0,5W,lin	V44215-Z3000-A5
		Übertrager TRANSFORMER	
Ü1	1		V45231-F3037
Ü2	1		V45231-F3038
L1	1	Spule COIL	V45231-F3036
C1,3	2	MKM-Kondensator MKM CAPACITOR 0,1 µF ±10%; 160V	B32435-A2104-K
C2	1	MKL-Kondensator MKL CAPACITOR 6,8 µF ±20%; 63V	B32110-E9685-M
C4,5	2	Styroflex-Kondensator STYROFLEX CAPACITOR 4700pF ±5%; 160V	B31863-B1472-J
C6	1	MKL-Kondensator MKL CAPACITOR 0,68 µF ±20%; 63V	B32110-E9684-M
C7	1	Styroflex-Kondensator STYROFLEX CAPACITOR 1000pF ±10%; 160V	B31861-A1102-K
C8	1	MKL-Kondensator MKL CAPACITOR 1,5 µF ±20%; 63V	B32110-E9155-M
C9	1	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C10	1	2240 pF ±1%; 160V	B31861-A1222-F400
C12	1	250 pF ±1%; 160V	B31861-A1251-F
C14	1	845 pF ±1%; 160V	B31861-A1841-F500
C15	1	Keramik-Kondensator CERAMIC CAPACITOR 20 pF ±10%; N150 500V	B38222-J5200-K003
C11	1	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,7...19 pF	C40208-Z130-A76
Ts1...4	4	Transistor TRANSISTOR	BCY 58 VIII
Gr1,2,3	3	Hot-Carrier-Diode HOT CARRIER DIODE	HP 2900
Gr4,6	2	Diode DIODE	BAW 75
Gr5,7	2	Zenerdiode ZENER DIODE ZF 6,8	V42292-H26-B

Netzteil S45035-D5143-B701

POWER SUPPLY UNIT

	1	Netzteilplatte POWER SUPPLY UNIT BOARD	S45035-D5147-A701
C1	1	Elko ELECTROLYTIC CAPACITOR 2500 µF +30/-20%; 35V	B41551-A7258-R
C2	1	Funkentstörkondensator RADIO NOISE SUPPRESSION CAP 0,025 µF + 2x2500pF	B81711-A-B21
Ts8,9	2	Transistor TRANSISTOR	2 N 3054
Gr1	1	Gleichrichter RECTIFIER	B60067-A1715-A2
Tr	1	Netztransformator MAINS TRANSFORMER	V45221-S3009
	1	Netzeinbaustecker POWER PLUG	V45207-S3003

Grundplatte 1 S45035-D5144-A701

BASE PLATE 1

R1	1	Schichtwiderstand LAYER-TYPE RESISTOR 79 Ohm ±0,5%; 0,25 W	B54412-A9790-D
L1,2	2	UKW-Drossel VHF CHOKE 23 µH	B82501-A-C16
C1,2,3	3	Keramik-Kondensator CERAMIC CAPACITOR 1500 pF +30/-20%; 500V	B37638-B5152-R003
C4,5	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M

Grundplatte 2 S45035-D5145-A701

BASE PLATE 2

L1,2,4	3	HF-Drossel RF CHOKE 100 µH	C44330-Z5-C9
C1...5	5	Tantal-Elko TANTAL ELECTROLYTIC CAP 15 µF ±20%; 20V	B45170-A3156-M

Eichleitung; (7x10 dB) S45034-D5052-B701

VARIABLE ATTENUATOR (7x10 dB)

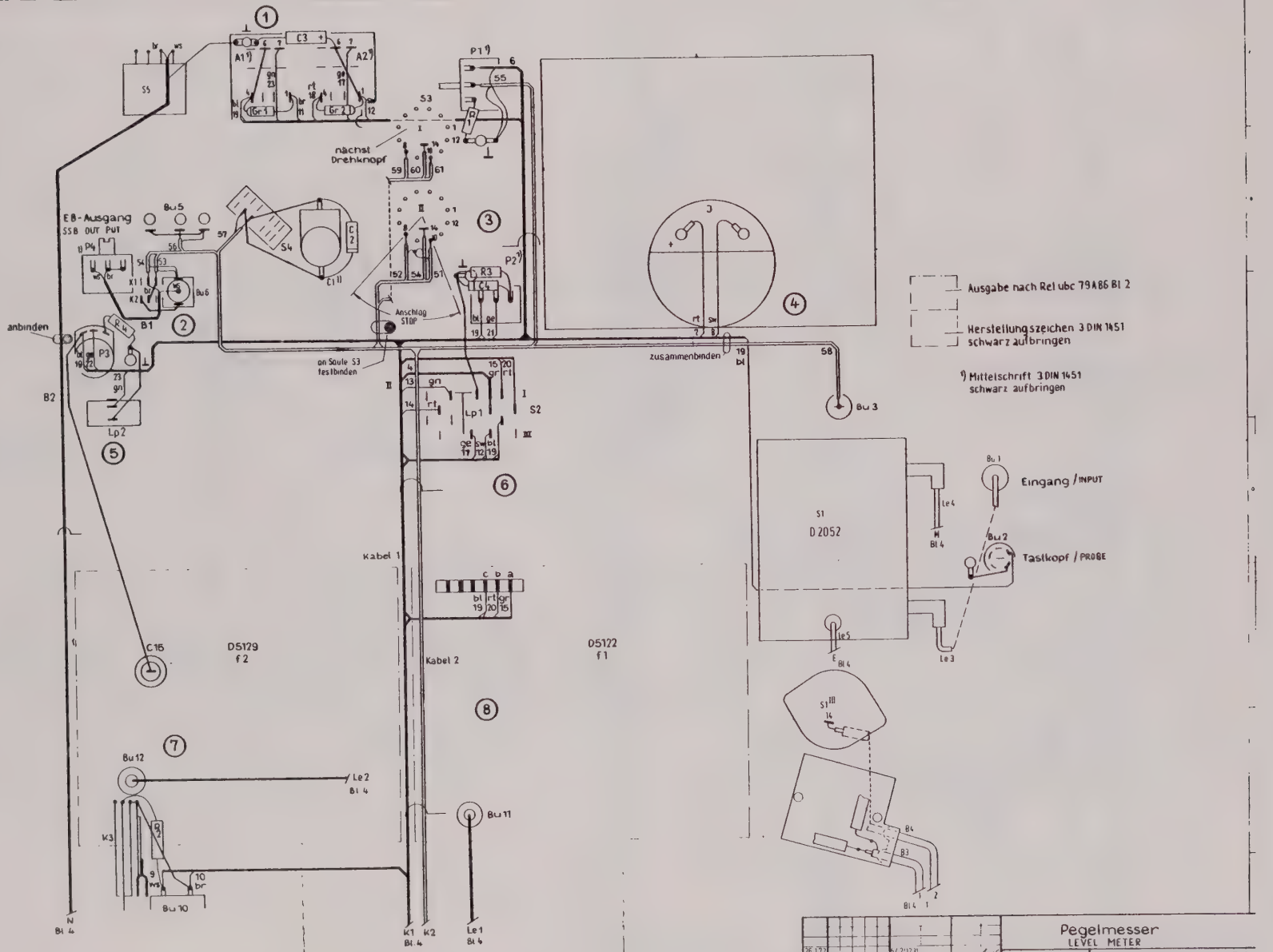
		Schichtwiderstand LAYER-TYPE RESISTOR	
R1		75 Ohm±5%; 0,15 W	B51262-A2750-J
R2	1	675 Ohm±2%; 0,15 W	B51262-A2671-G500
R3	1	216 Ohm±0,2%; 0,27 W	B51264-A9211-C600
R4	1	68,4Ohm±0,2%; 0,27 W	B51264-A9684-C400
R5	1	21,6Ohm±0,2%; 0,27 W	B51264-A9216-C600
R6	1	10 Ohm±0,2%; 0,27 W	B51264-A9100-C
		Dämpfungsglied	
IC1	1	0 dB	B91124-A10
IC2	1	10 dB	B91124-A11-A3
IC3	1	20 dB	B91124-A12-A3
IC4	1	30 dB	B91124-A13-A3
IC5	1	40 dB	B91124-A14-A3
IC6	1	50 dB	B91124-A15-A3
IC7	1	60 dB	B91124-A16-A3
IC8		70 dB	B91124-A17-A3

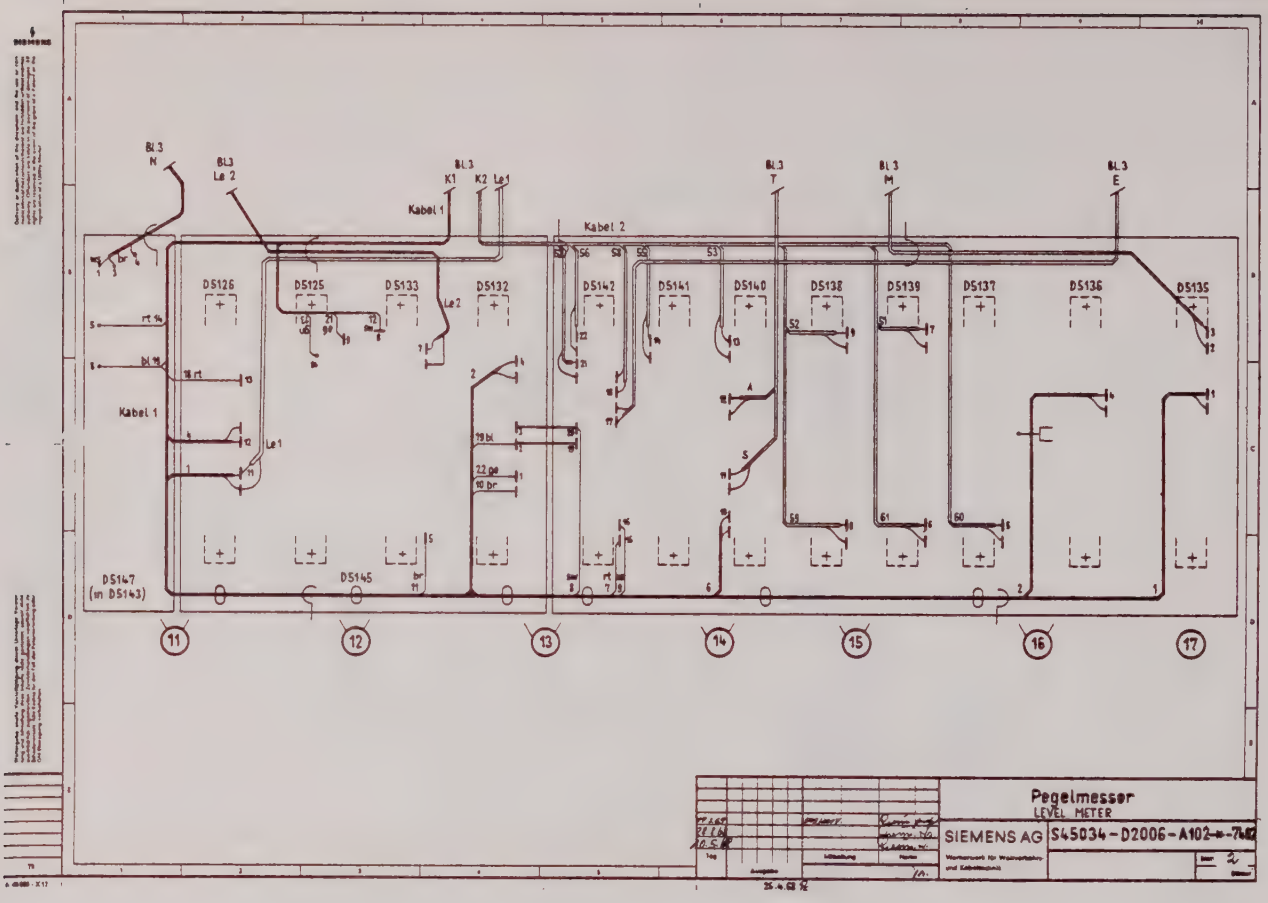
Netzteilplatte S45035-D5147-A701

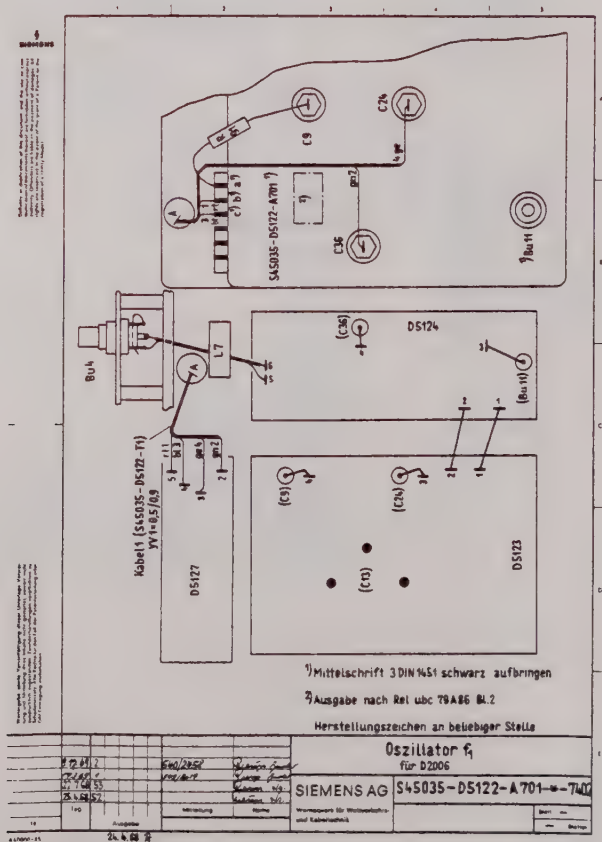
POWER SUPPLY UNIT BOARD

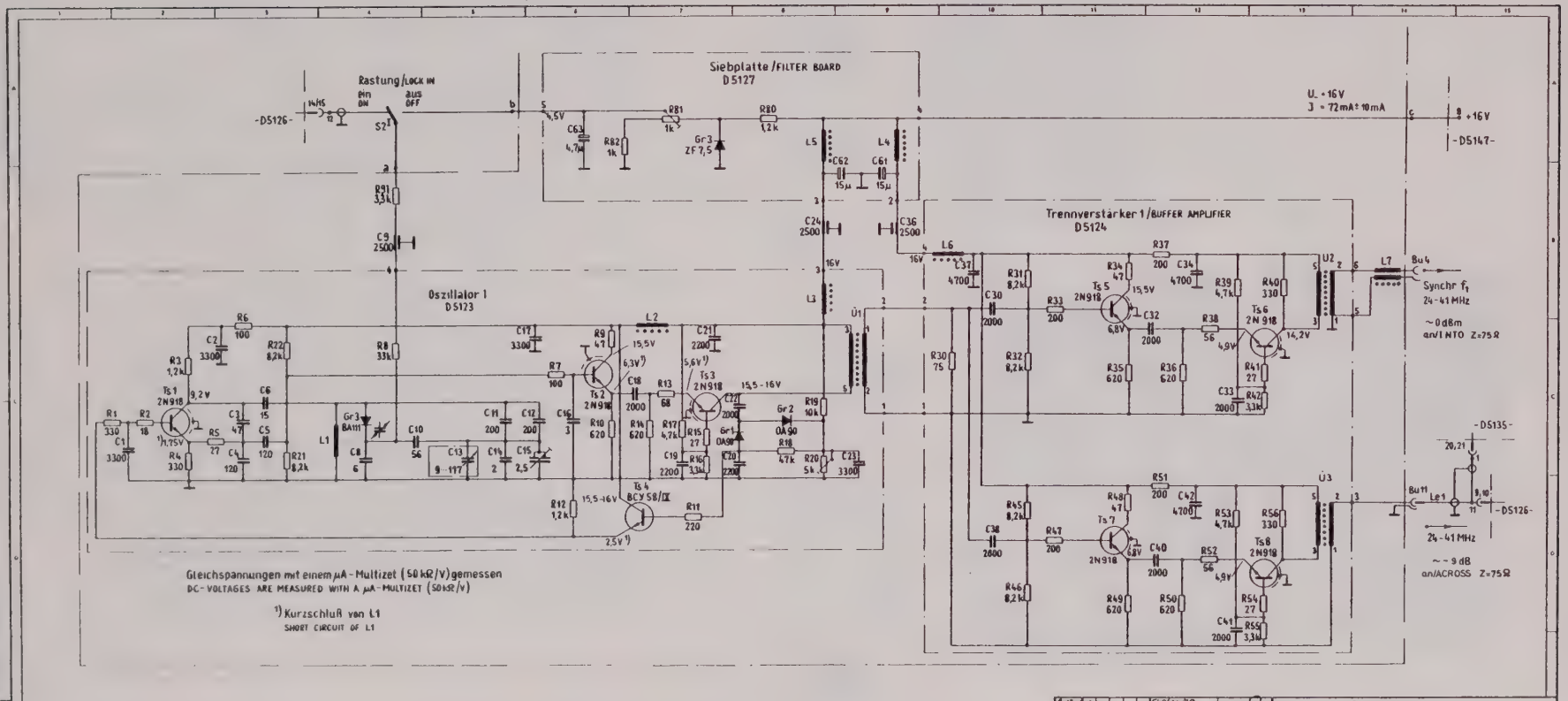
		Schichtwiderstand LAYER-TYPE RESISTOR	
R1	1	2 kOhm±5%; 0,15 W	B51262-A2202-J
R4	1	3,6kOhm±5%; 0,15 W	B51262-A2362-J
R6	1	5,6kOhm±5%; 0,15 W	B51262-A2562-J
R7,8,14	3	3,3kOhm±5%; 0,15 W	B51262-A2332-J
R10,15, 18,19	4	1 kOhm±5%; 0,15 W	B51262-A2102-J
R11	1	6 kOhm±5%; 0,15 W	B51262-A2602-J
R13	1	5,1kOhm±5%; 0,15 W	B51262-A2512-J

		Metallschichtwiderstand METAL LAYER-TYPE RESISTOR	
R9	1	o,82 Ohm±5%; o,5 W	B54414-A2ooo-J82
R17	1	2,2 Ohm±5%; o,5 W	B54414-A2o2o-J2oo
		Schichtdrehwiderstand VAR LAYER-TYPE RESISTOR	
R5,12	2	2,2kOhm±2o%; o,8W, lin	V44215-Z3oo8-A8
R16	1	22o Ohm±2o%; o,8W, lin	V44215-Z3oo8-A5
C2,3	2	Keramik-Kondensator CERAMIC CAPACITOR 1oooo pF+2o-3o%; 5oo V	B37644-B51o3-R
Ts2,4, 5,7	4	Transistor TRANSISTOR	BCY 59 VIII
Ts3,6	2	Transistor TRANSISTOR	BSX 63 - 6
Ts1o	1	Transistor TRANSISTOR	BSX 62 C
Gr2,3,4	3	Zenerdiode ZENER DIODE	ZF 6,8
Gr5	1	Zenerdiode ZENER DIODE	ZF 5,6
		Wandler S45o35-D5148-B7o1 DC/DC INVERTER	
Gr1,3,4	3	Diode DIODE	1 N 4817
	1	wandlerplatte INVERTER BOARD	S45o35-D5149-A7o1
		Wandlerplatte S45o35-D5149-A7o1 INVERTER BOARD	
		Schichtwiderstand LAYER-TYPE RESISTOR	
R1,2	2	18 Ohm±5%; o,15 W	B51262-A2180-J
R5	1	1o kOhm±5%; o,15 W	B51262-A21o3-J
R6	1	2,2kOhm±5%; o,15 W	B51262-A2222-J
R7	1	82o Ohm±5%; o,15 W	B51262-A2821-J
R8	1	5,1kOhm±5%; o,15 W	B51262-A2512-J
		Metallschichtwiderstand METAL LAYER-TYPE RESISTOR	
R3	1	91o Ohm±5%; 1 W	B54513-A911-J
R4	1	22o Ohm±5%; 2 W	W4o149-A6221-J2
U1	1	Übertrager TRANSFORMER	V4523o-N3o15
U2	1	Übertrager TRANSFORMER	V45285-B3oo1
C1,2	2	Tantal-Elko TANTAL ELECTROLYTIC CAP 1,5/uF ±2o%; 5o V	B4517o-A5155-M
C3	1	MKL-Kondensator MKL CAPACITOR 1,5/uF ±2o%; 63 V	B3211o-E9155-M
		Tantal-Elko TANTAL ELECTROLYTIC CAP	
C4	1	1 /uF ±2o%; 5o V	B4517o-J51o5-M
C5	1	22 /uF ±2o%;1oo V	B45264-A9226-M
C6	1	22 /uF ±2o%; 25 V	B45264-A4226-M
C7	1	4,7/uF ±2o%;1oo V	B45264-A9475-M
A	1	Relais RELAY	V23162-Bo719-B11o
Ts1,2	1	Transistorpaar TRANSISTOR PAIR	Q627o2-U58-S3 2 N 3o55
Ts3	1	Transistor TRANSISTOR	BCY 58 VIII
Ts4	1	Transistor TRANSISTOR	BCY 78 VII
Gr2,5...8	5	Diode DIODE	1 N 4817
Gr9	1	Diode DIODE	DX 6393
Gr1o	1	Zenerdiode ZENER DIODE	BZX 55 C13V5

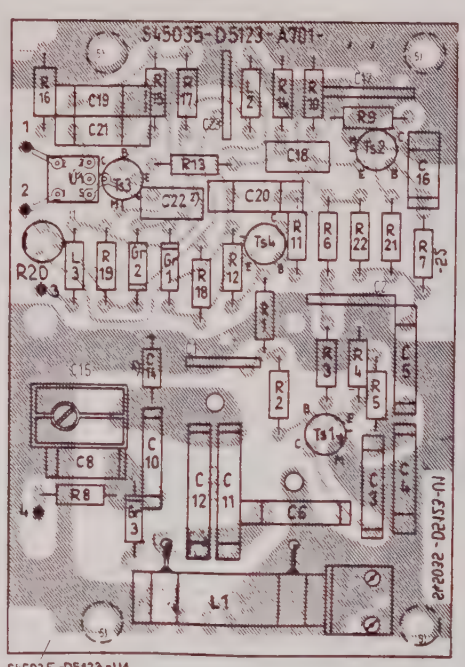

Ausgabe nach Rel ubc 79 A86 Bl 2
Herstellungszeichen 3 DIN 1451 schwarz aufbringen
1) Mittelschrift 3 DIN 1451 schwarz aufbringen
EB-Ausgang
SSB OUT PUT
anbinden
an Säule S3 festbinden
zusammenbinden
nächst Drehknopf
Anschlag STOP
Eingang / INPUT
Tastkopf / PROBE
Kabel 1
Kabel 2
D5129 f2
D5122 f1
S1 D 2052
Pegelmesser
LEVEL METER
SIEMENS AG
S45034-D2006-B102-W-7402

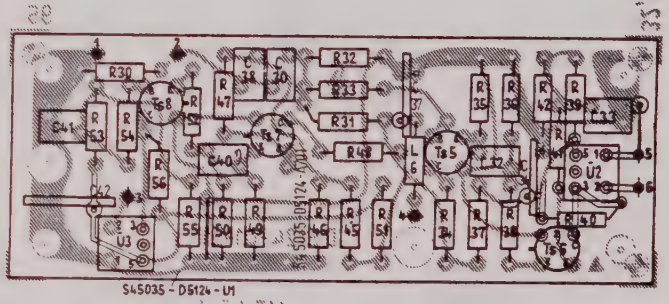

BL3 N
BL3 Le 2
BL3 K1 K2 Le1
Kabel 1
Kabel 2
BL3 T
BL 3 M
BL3 E
DS126
DS125
DS133
DS132
DS142
DS141
DS140
DS138
DS139
DS137
DS136
DS135
Le2
Le1
DS147 (in DS143)
DS145
11
12
13
14
15
16
17
Pegelmesser
LEVEL METER
SIEMENS AG
S45034-D2006-A102-=-7402


C24
C9
C36
S45035-D5122-A701 1)
Bu11
Bu4
L7
DS124
(C35)
(Bu11)
(C9)
(C24)
(C13)
DS123
DS127
Kabel1 (S45035-D5122-F1)
YV1=0,5/0,9
1) Mittelschrift 3 DIN 461 schwarz aufbringen
3) Ausgabe nach Rel ubc 79 A86 BL 2
Herstellungszeichen an beliebiger Stelle
Oszillator f1
für D2006
SIEMENS AG
S45035-D5122-A701-=-7402


Rastung/LOCK IN
EIN ON
AUS OFF
-D5126-
S2
Siebplatte/FILTER BOARD
D5127
U_ +16V
J = 72mA ± 10mA
+16V
-D5147-
Trennverstärker 1/BUFFER AMPLIFIER
D5124
Oszillator 1
D5123
Synchr f1
24-41 MHz
~0dBm
an/INTO Z=75Ω
-D5135-
-D5126-
24-41 MHz
~-9dB
an/ACROSS Z=75Ω
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
1) Kurzschluß von L1
SHORT CIRCUIT OF L1

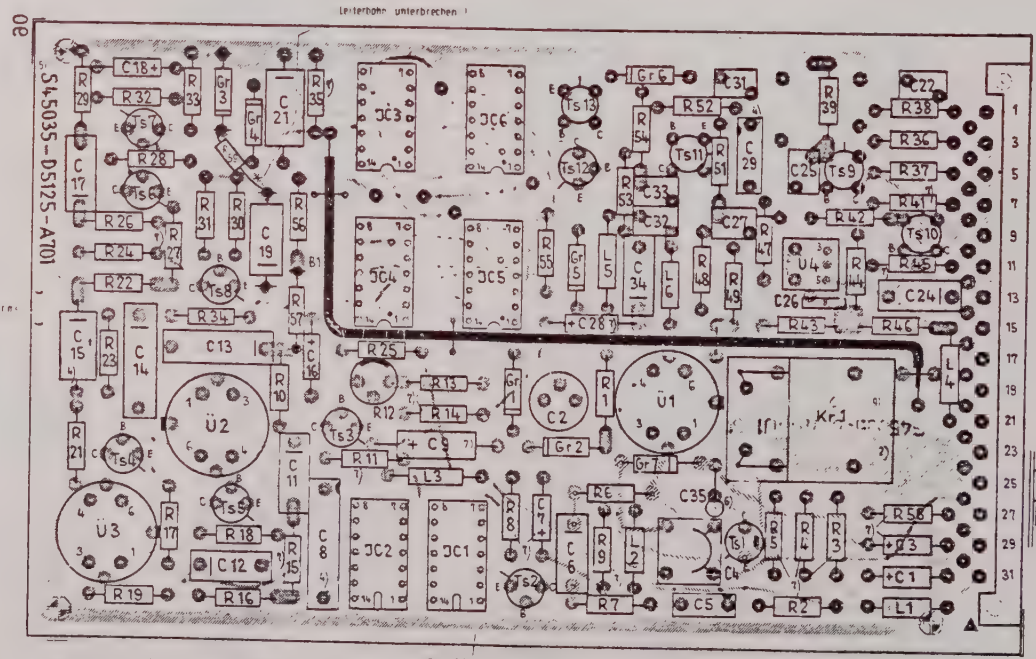
| | | |





Oszillator 1
für D2006
SIEMENS & HALSKE
S45035-D5123-A701-*-7402

Trennverstärker 1
BUFFER AMPLIFIER
für D2006
SIEMENS & HALSKE
S45035-D5124-A701-*-7402

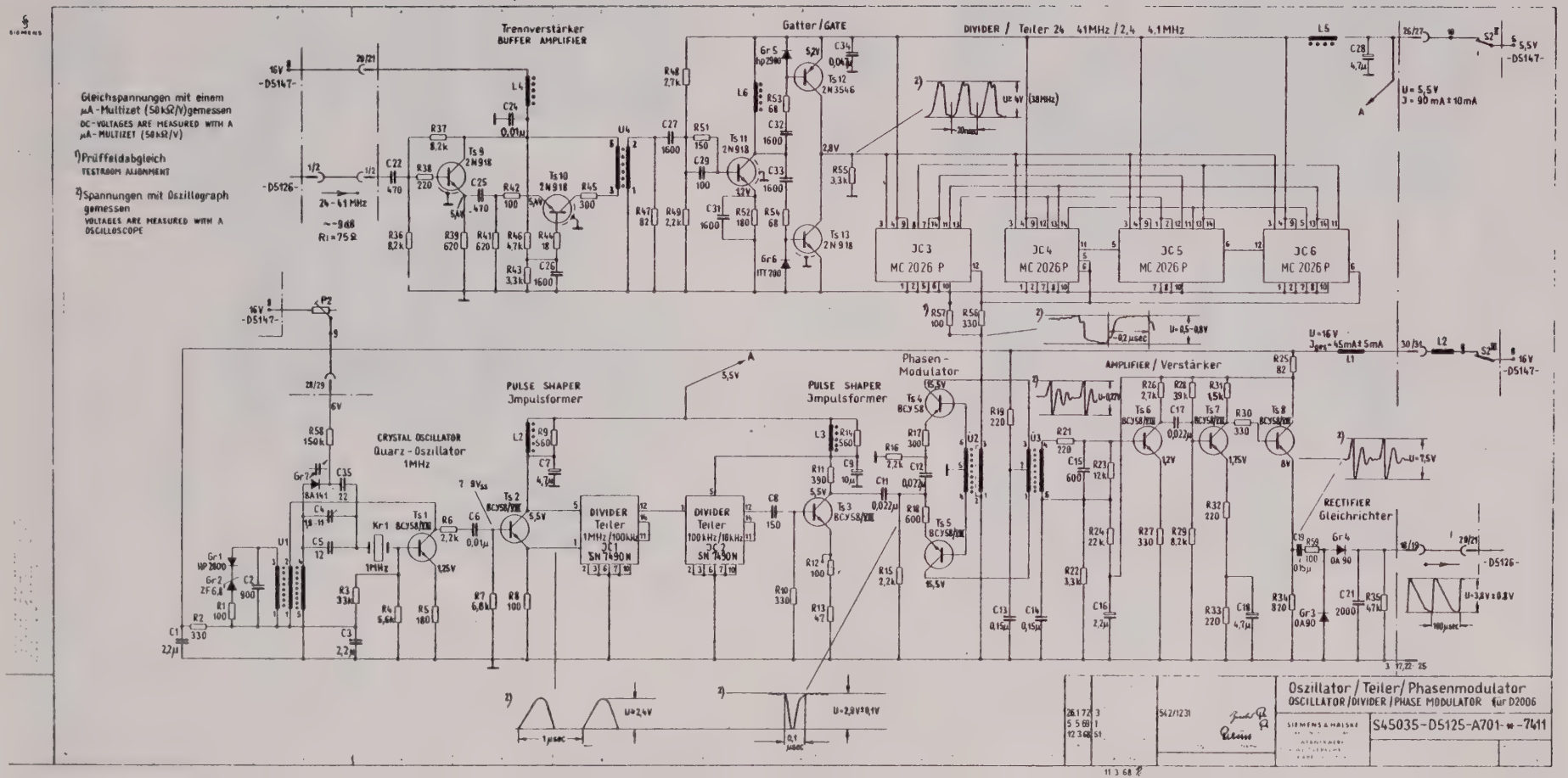


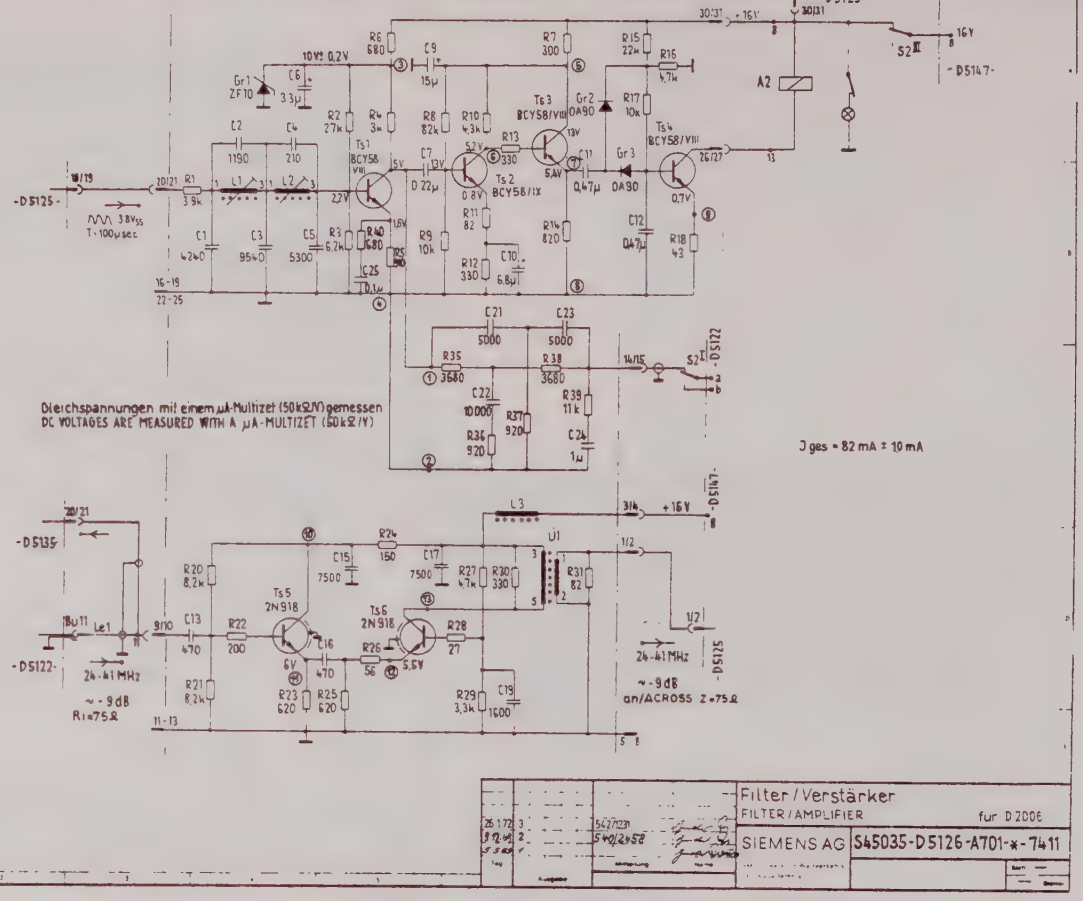
Cu-Draht 0,5
verlöten
Biegerichtung beachten!
einschwallen
Teflonkabel B1 : W41251-W6178-B50

2) S4
4) Abstand
5) Mittelschrift 3 DIN 1451 schwarz aufbringen
7) Abstand
8) Gewebeschlauch 4 mm
9) 95

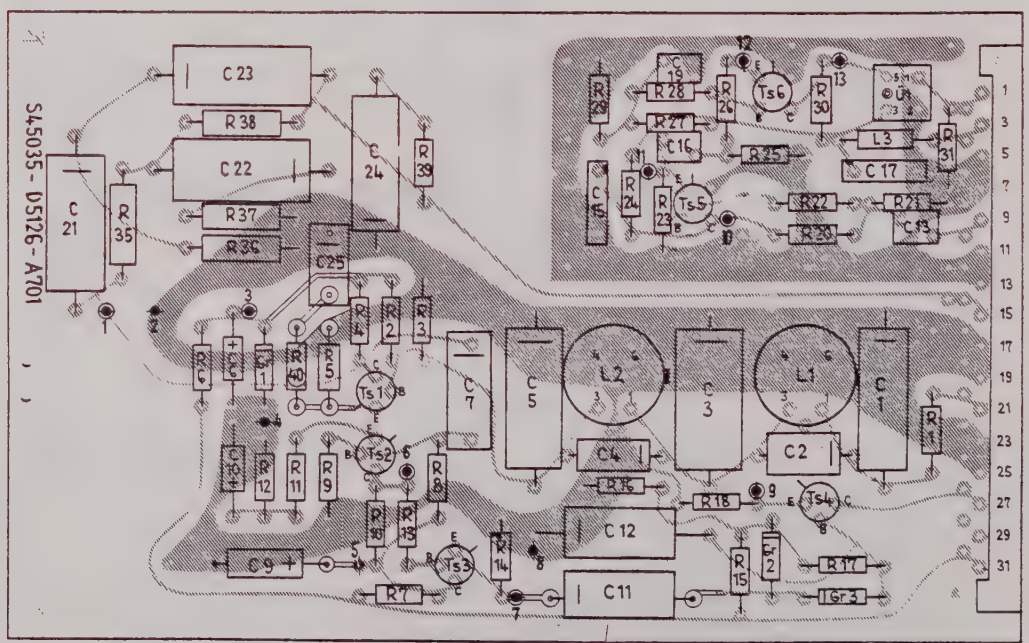
◆ 75

Oszillator / Teiler / Phasenmodulator
OSCILLATOR/DIVIDER/PHASE MODULATOR
für D2006
SIEMENS AG
S45035-D5125-A701-*-7402

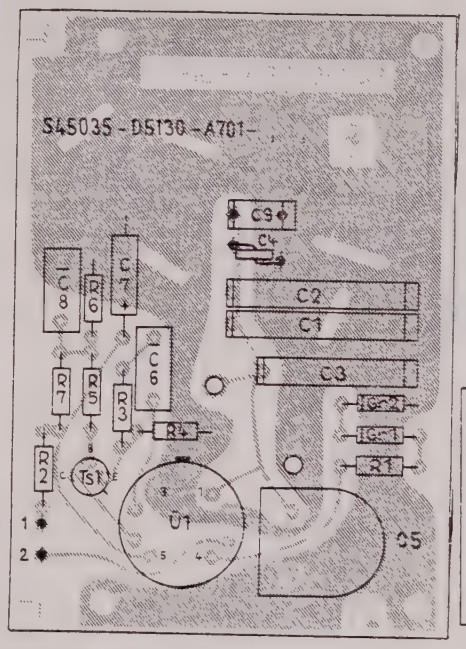

Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
1) Prüffeldabgleich
TESTROOM ALIGNMENT
2) Spannungen mit Oszillograph gemessen
VOLTAGES ARE MEASURED WITH A OSCILLOSCOPE
Trennverstärker
BUFFER AMPLIFIER
Gatter/GATE
DIVIDER / Teiler 24 41MHz / 2,4 4,1MHz
AMPLIFIER / Verstärker
PULSE SHAPER
Impulsformer
CRYSTAL OSCILLATOR
Quarz-Oszillator
1MHz
Phasen-Modulator
RECTIFIER
Gleichrichter
DIVIDER Teiler 1MHz/100kHz JC1 SN 7490N
DIVIDER Teiler 100kHz/10kHz JC2 SN 7490N
JC3 MC 2026 P
JC4 MC 2026 P
JC5 MC 2026 P
JC6 MC 2026 P
-DS147-
-DS126-
U = 5,5V
J = 90 mA ± 10mA
U = 16 V
Jges = 45mA ± 5mA
Oszillator / Teiler / Phasenmodulator
OSCILLATOR / DIVIDER / PHASE MODULATOR für D2006
S45035-D5125-A701-*-7411
SIEMENS & HALSKE



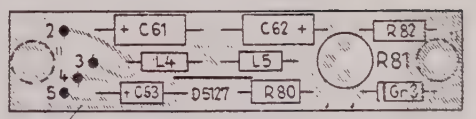
Filter / Verstärker
FILTER / AMPLIFIER
für D 2006
SIEMENS AG
S45035-D5126-A701-*-7411



Filter / Verstärker
FILTER / AMPLIFIER
f. D 2006
SIEMENS & HALSKE
WERNERWERK FÜR WEITVERKEHRS- UND KABELTECHNIK
S45035 - D5126 - A701-*-7411

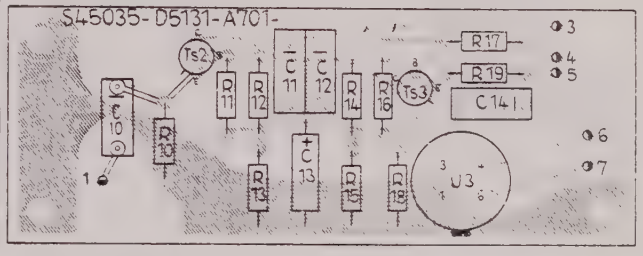


S45035-D5130-U1



S45035-D5127-U1

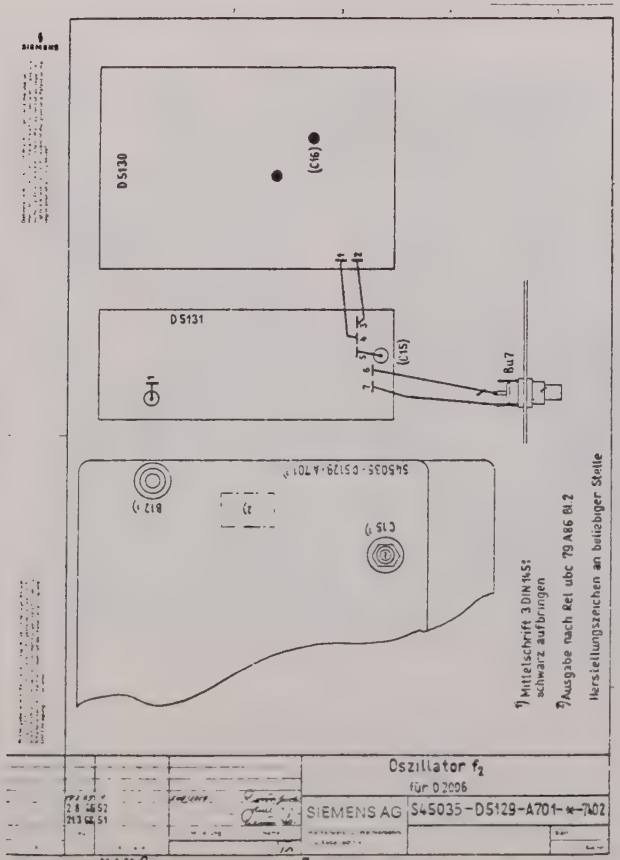
Siebplatte		
FILTER BOARD	für D 2006	
SIEMENS & HALSKE	S45035-D5127-A701-*-7402	



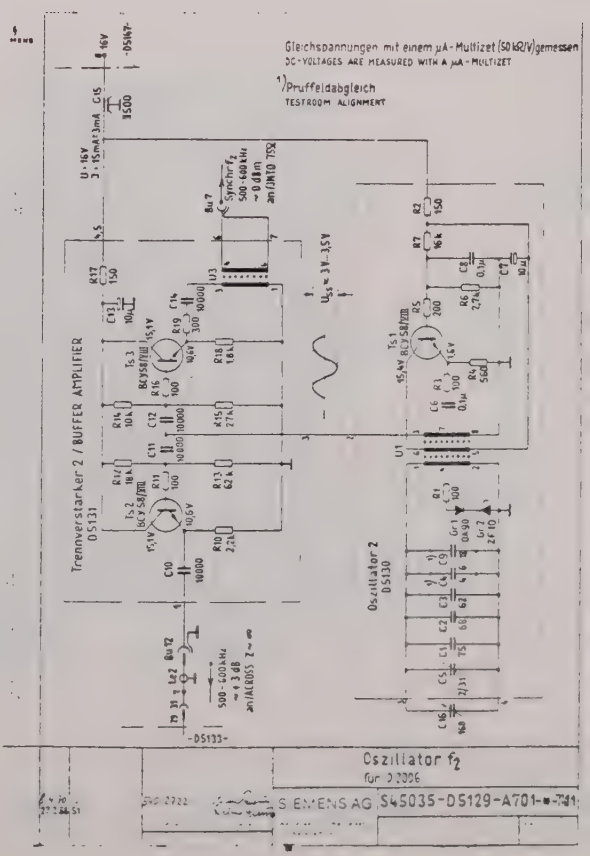
S45035-D5131-U1

Oszillator 2		
für D 2006		
SIEMENS & HALSKE	S45035-D5130-A701-*-7402	

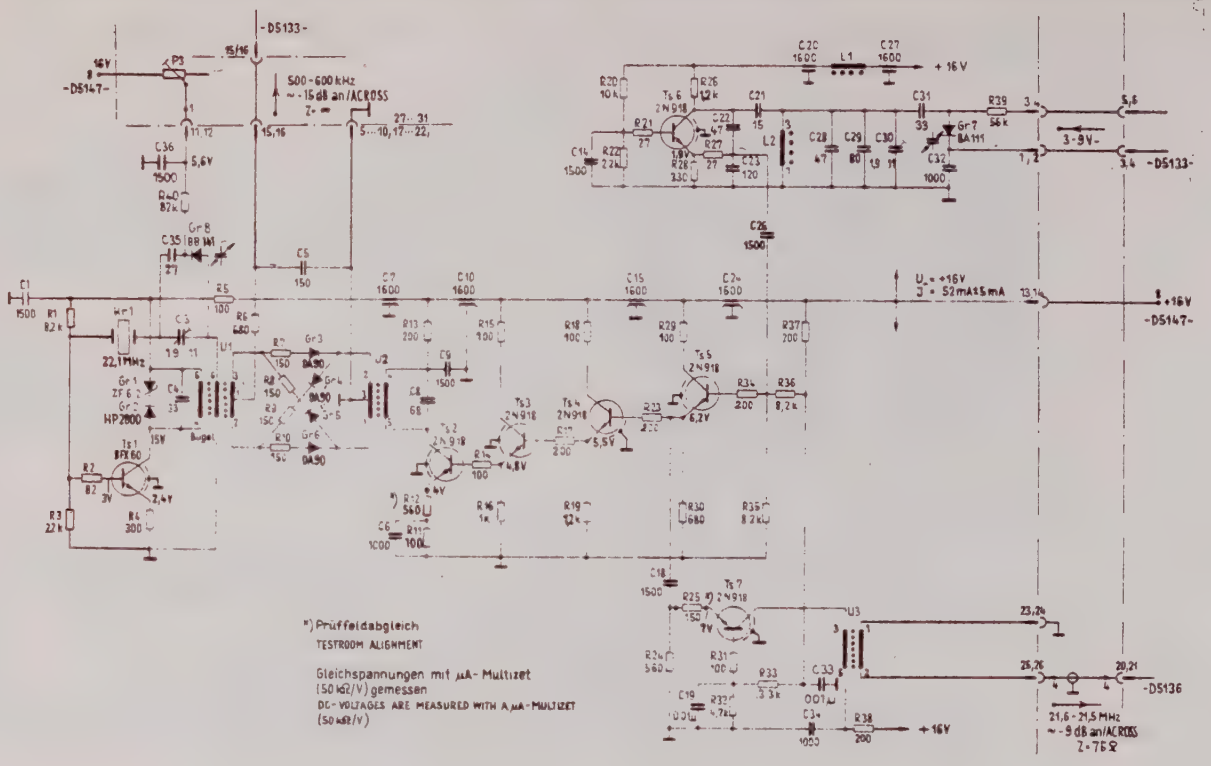
Trennverstärker 2		
BUFFER AMPLIFIER	für D 2006	
SIEMENS & HALSKE	S45035-D5131-A701-*-7402	



Oszillator f_2		
für D 2006		
SIEMENS AG	S45035-D5129-A701-*-7402	

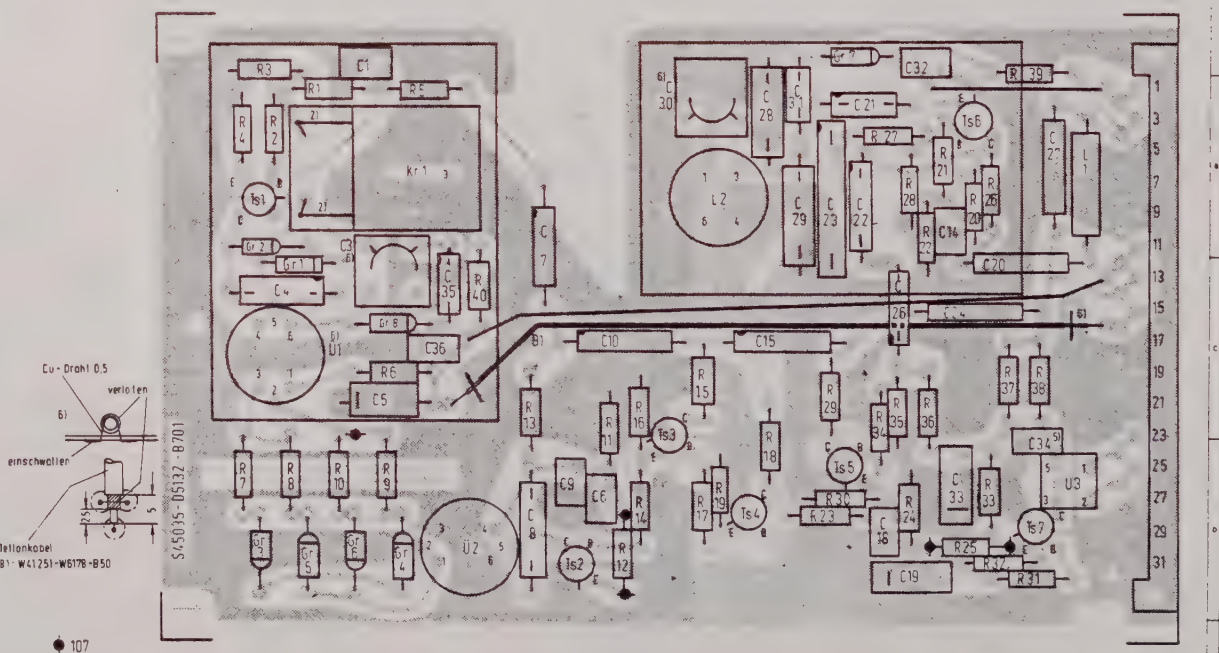


Oszillator f_2		
für D 2006		
SIEMENS AG	S45035-D5129-A701-*-7401	



Oszillator / Modulator
für D2006

SIEMENS AG | S 45035-D5132-B701-*-7411



2) Anschlußdrähte eintödeln und verlöten

3) 111

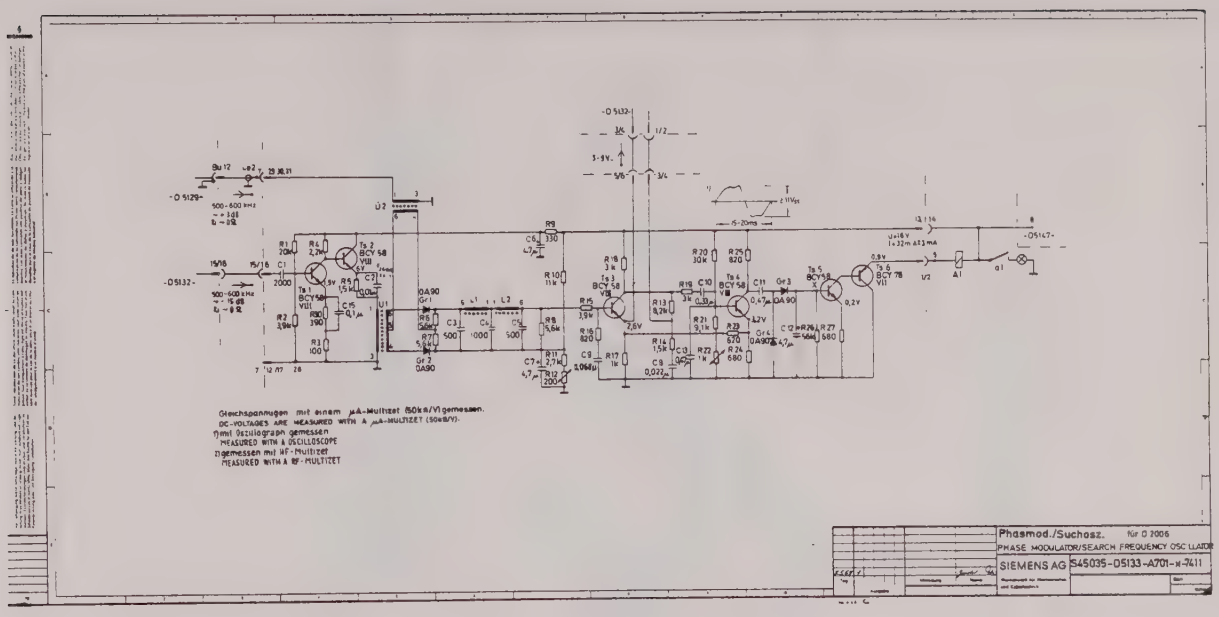
5) Gewebeschlauch 4mm

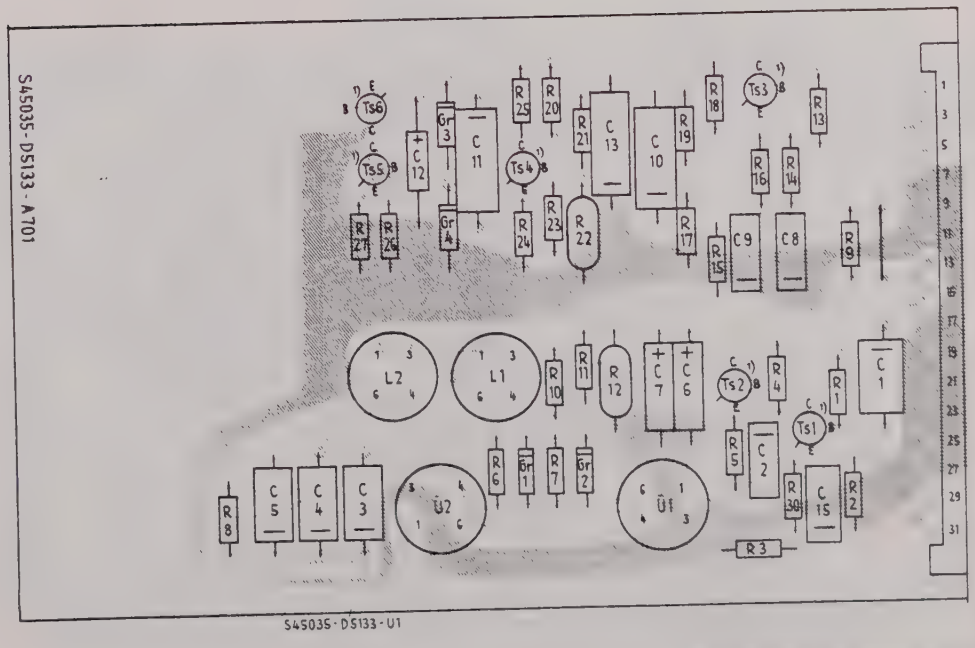
6) Am Deckel oberhalb der Bohrungen beschriften

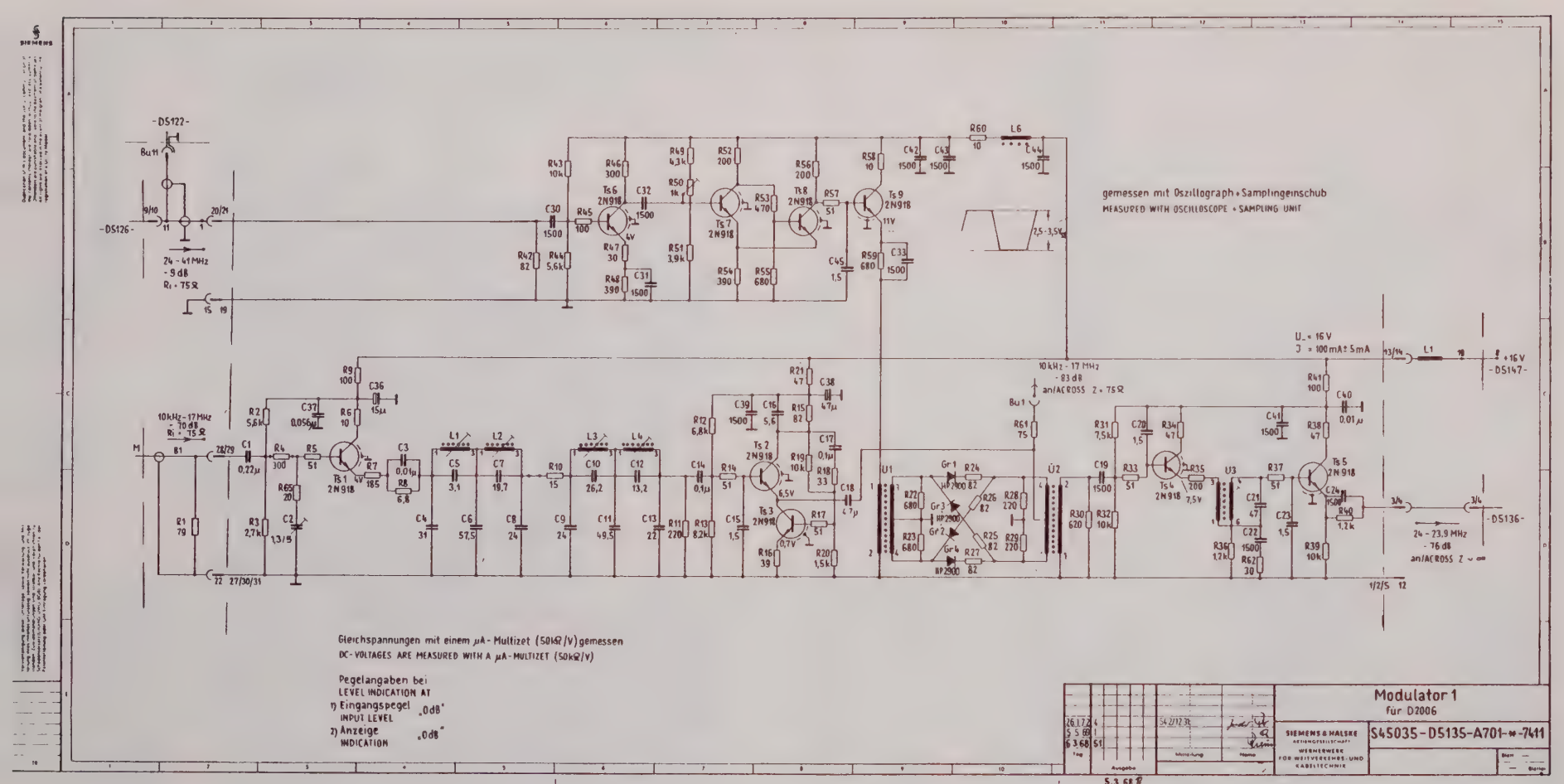
S45035-D5132-U2

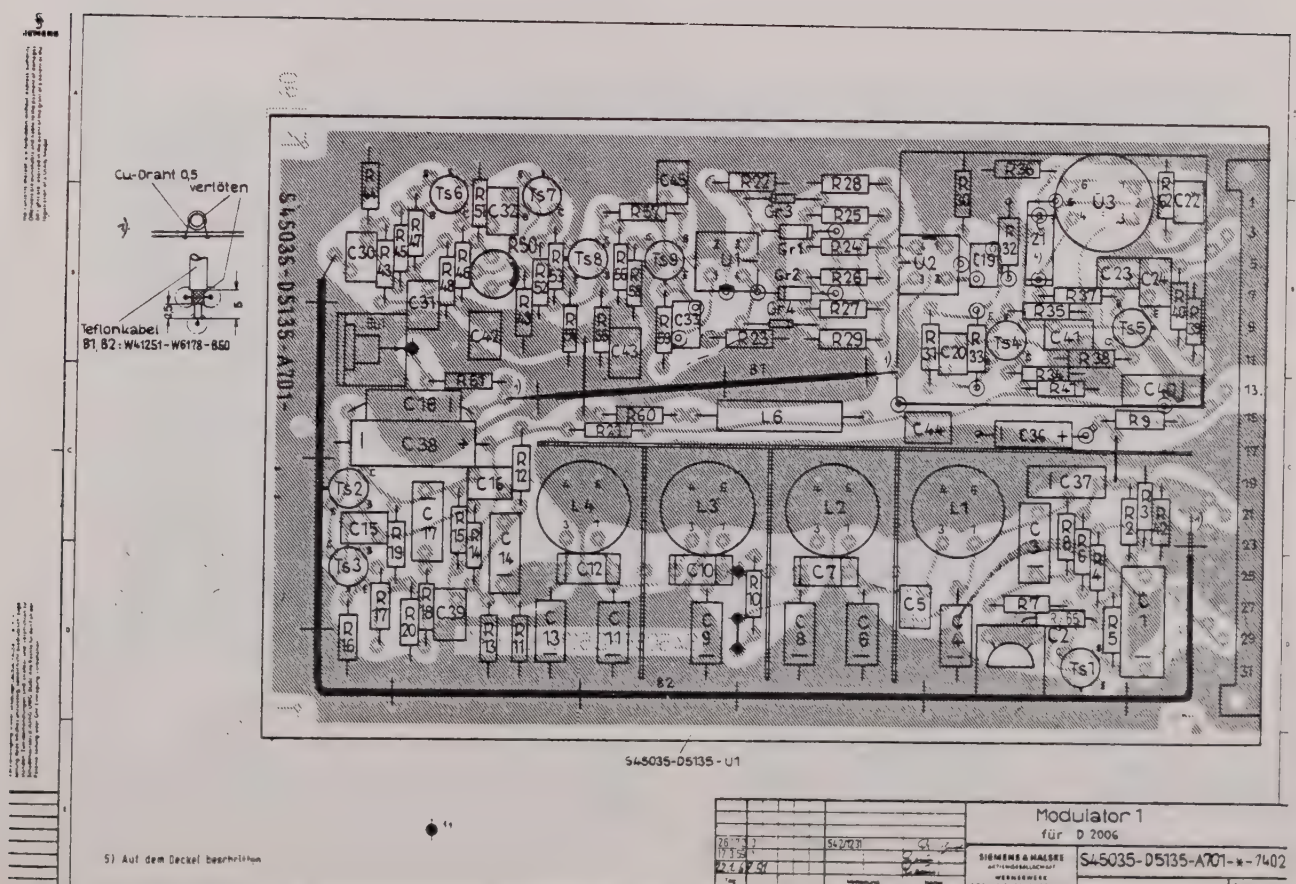
Oszillator / Modulator
für D 2006

SIEMENS AG | S 45035-D5132-B701-*-7402

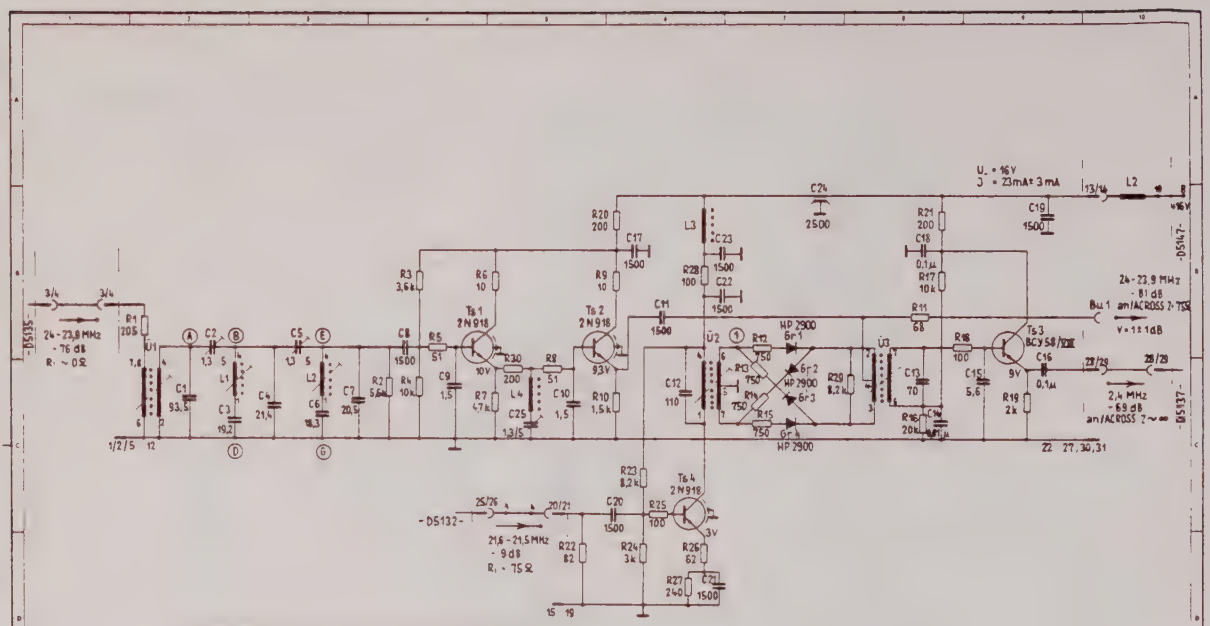

Gleichspannungen mit einem µA-Multizet 50kΩ/V gemessen.
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V).
η mit Oszillograph gemessen
MEASURED WITH A OSCILLOSCOPE
ζ gemessen mit HF-Multizet
MEASURED WITH A RF-MULTIZET
Phasmod./Suchosz. für D 2006
PHASE MODULATOR/SEARCH FREQUENCY OSCILLATOR
SIEMENS AG S45035-D5133-A701-X-7411

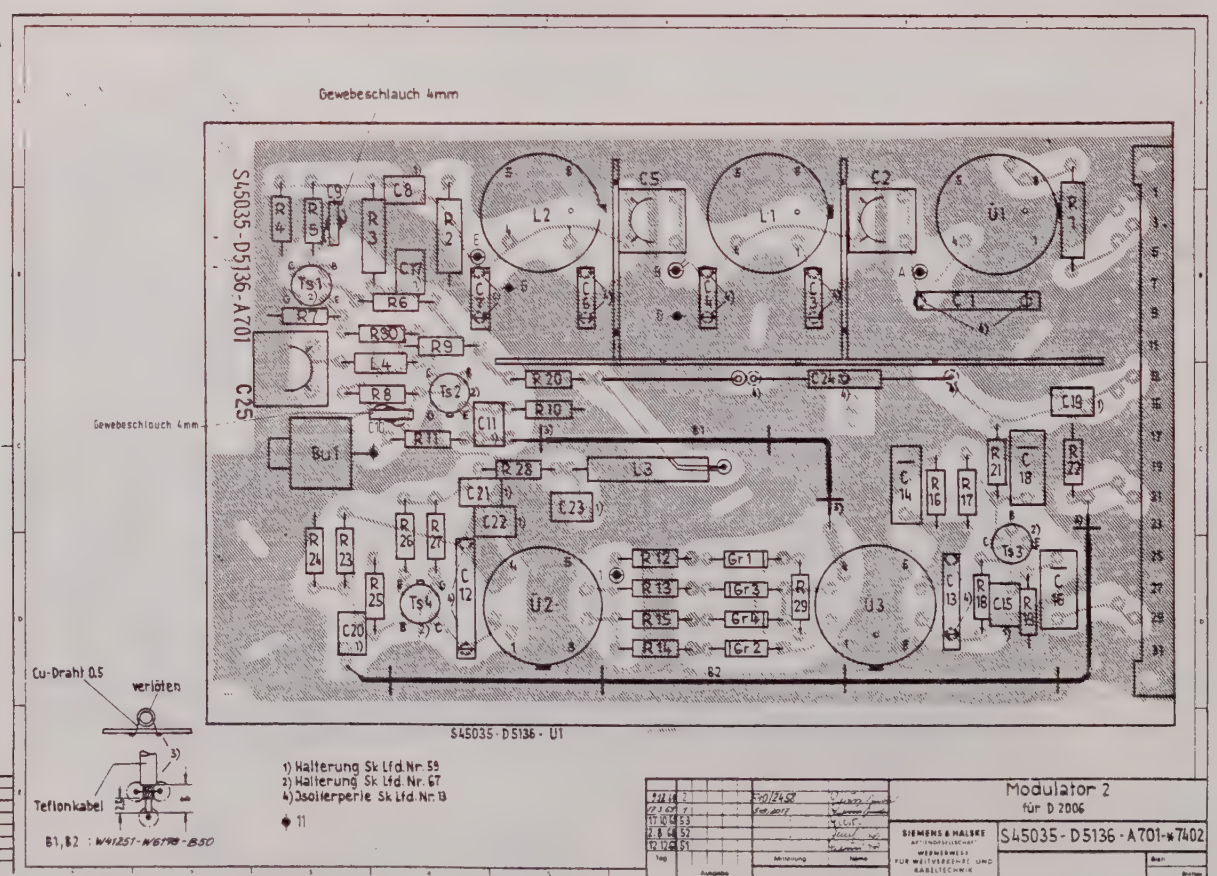

S45035-D5133-A701
S45035-D5133-U1
η Sk-Lfd. Nr. 59
PHASE MODULATOR / SEARCH FREQUENCY OSCILLATOR
Phasenmodulator / Suchoszillator
für D 2006
SIEMENS & HALSKE
S45035-D 5133-A 701+702

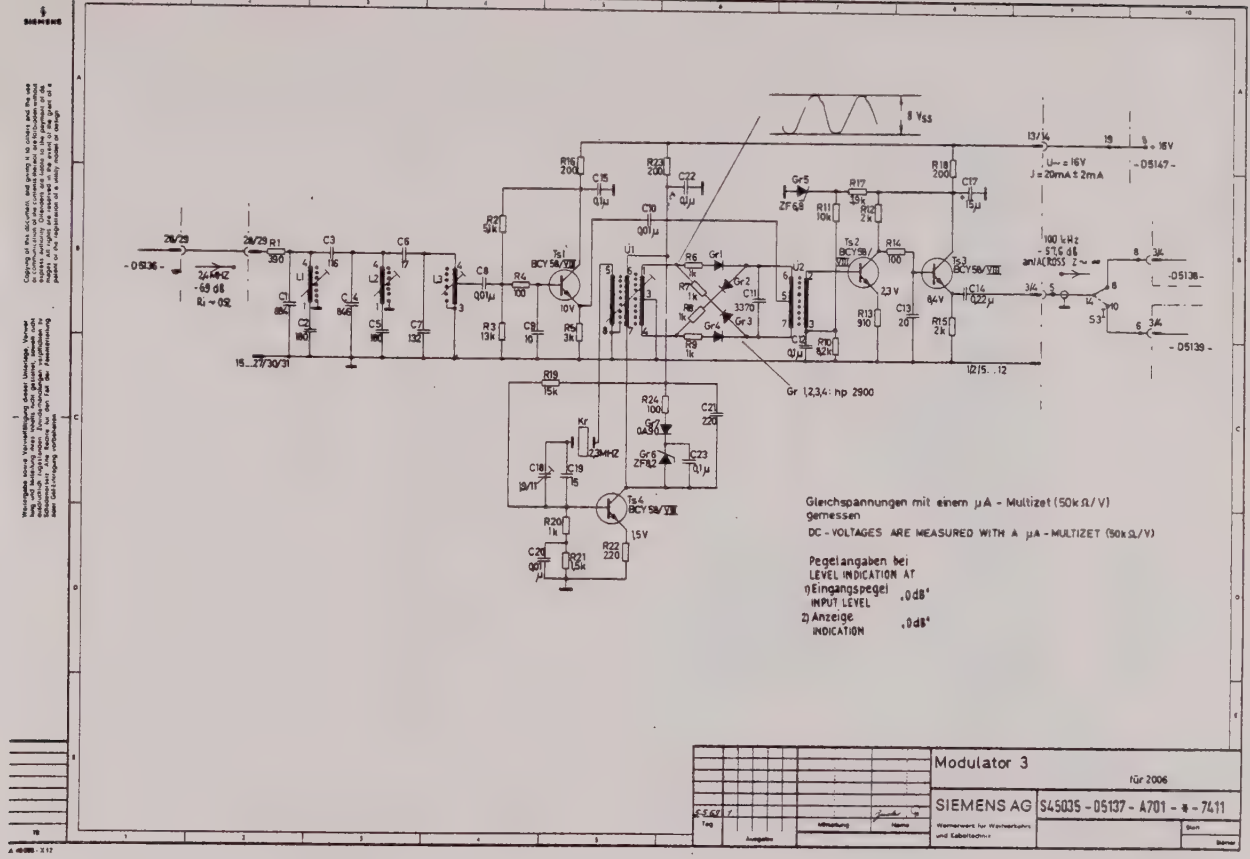

-DS122-
-DS126-
24 - 41 MHz
- 9 dB
Ri = 75 Ω
gemessen mit Oszillograph + Samplingeinschub
MEASURED WITH OSCILLOSCOPE + SAMPLING UNIT
2,5 - 3,5 V
U = 16 V
J = 100 mA ± 5 mA
+16 V
-DS147-
10 kHz - 17 MHz
- 70 dB
Ri = 75 Ω
10 kHz - 17 MHz
- 83 dB
an/ACROSS Z = 75 Ω
24 - 23,9 MHz
- 76 dB
an/ACROSS Z ∼ ∞
-DS136-
Gleichspannungen mit einem µA - Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
Pegelangaben bei
LEVEL INDICATION AT
1) Eingangspegel „0dB"
INPUT LEVEL
2) Anzeige „0dB"
INDICATION
Modulator 1
für D2006
SIEMENS & HALSKE
S45035-D5135-A701-**-7411

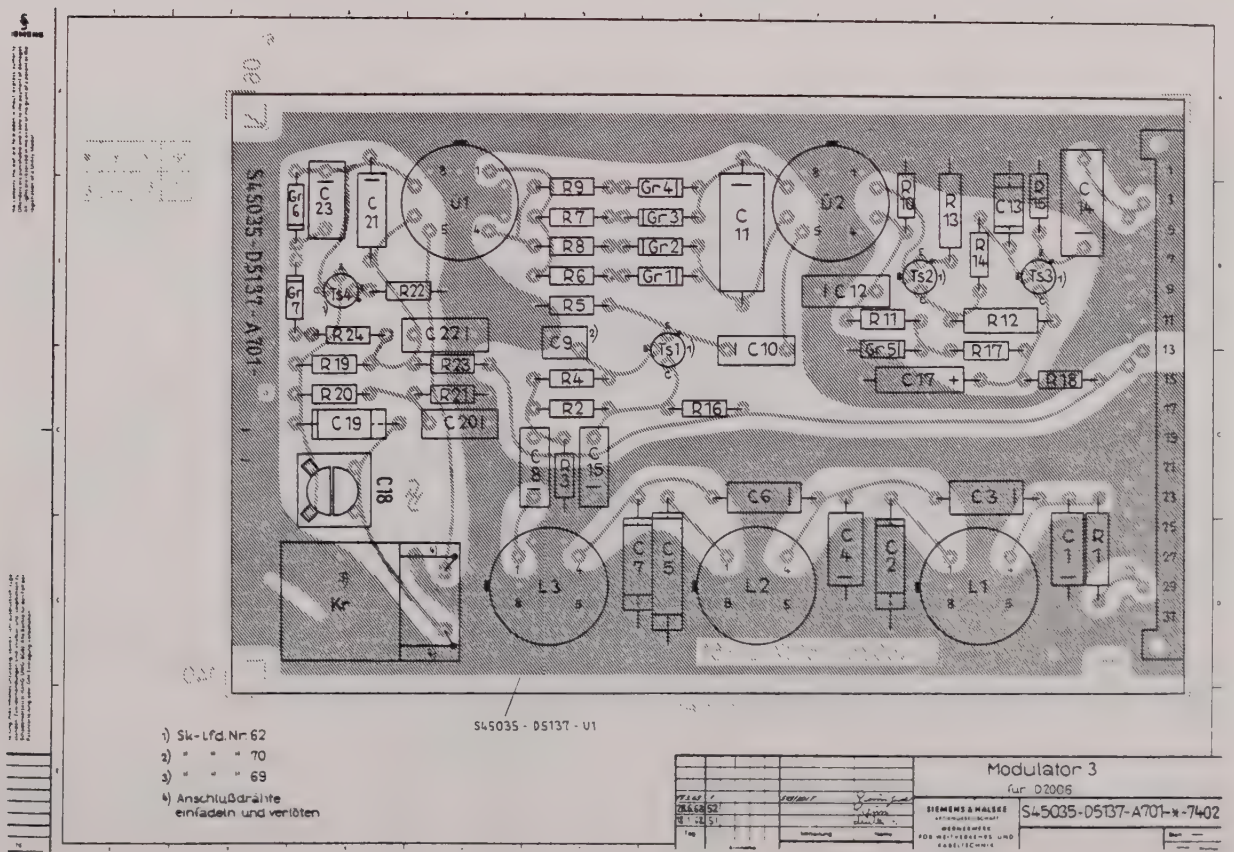


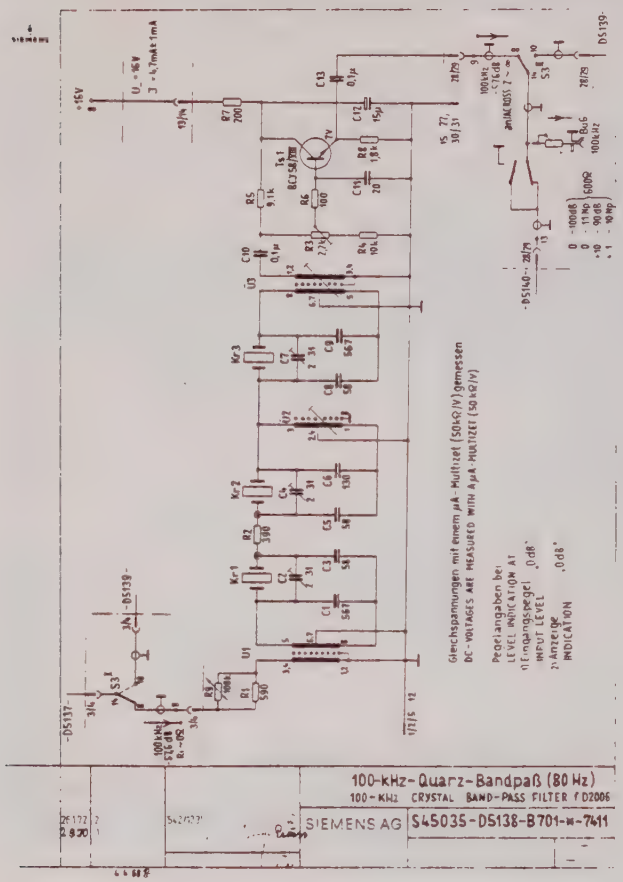
5) Auf dem Deckel beschriften

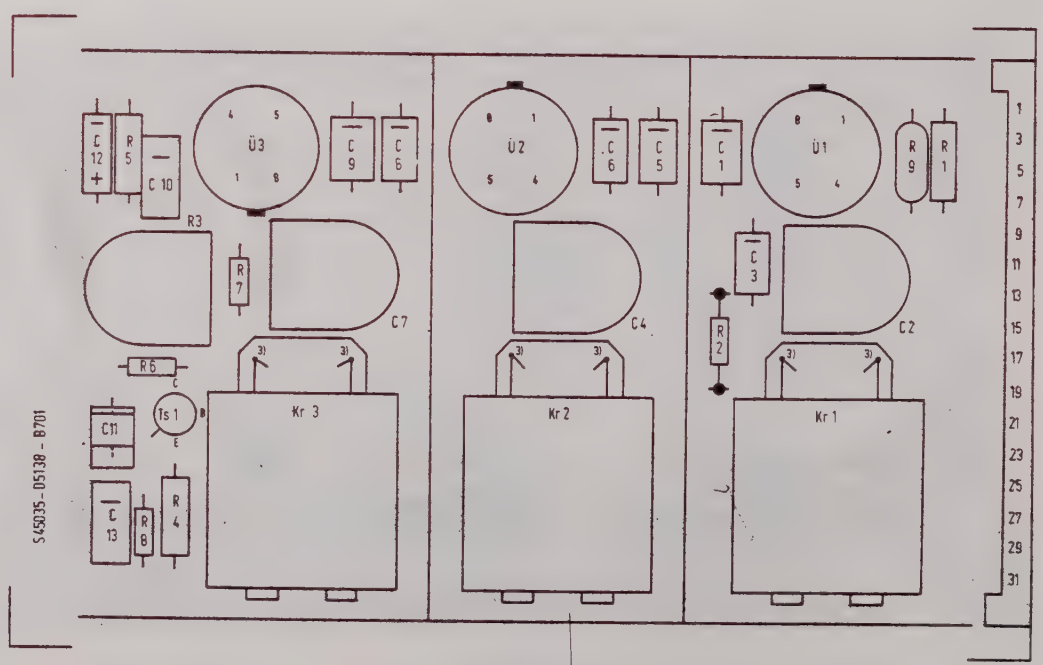

Gleichspannungen mit einem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50 kΩ/V)
Pegelangaben bei
LEVEL INDICATION AT
1) Eingangspegel INPUT LEVEL „0 dB"
2) Anzeige INDICATION „0 dB"
Modulator 2
für D 2006
SIEMENS AG
S45035-D5136-A701-*-7411


Gewebeschlauch 4mm
S45035-D5136-A701
C25
Gewebeschlauch 4mm
Cu-Draht 0,5
verlöten
Teflonkabel
B1,B2 : W41251-W6198-B50
S45035-D5136-U1
1) Halterung Sk Lfd.Nr. 59
2) Halterung Sk Lfd. Nr. 67
4) Isolierperle Sk Lfd. Nr. 13
Modulator 2
für D 2006
SIEMENS & HALSKE
S45035-D5136-A701-*7402

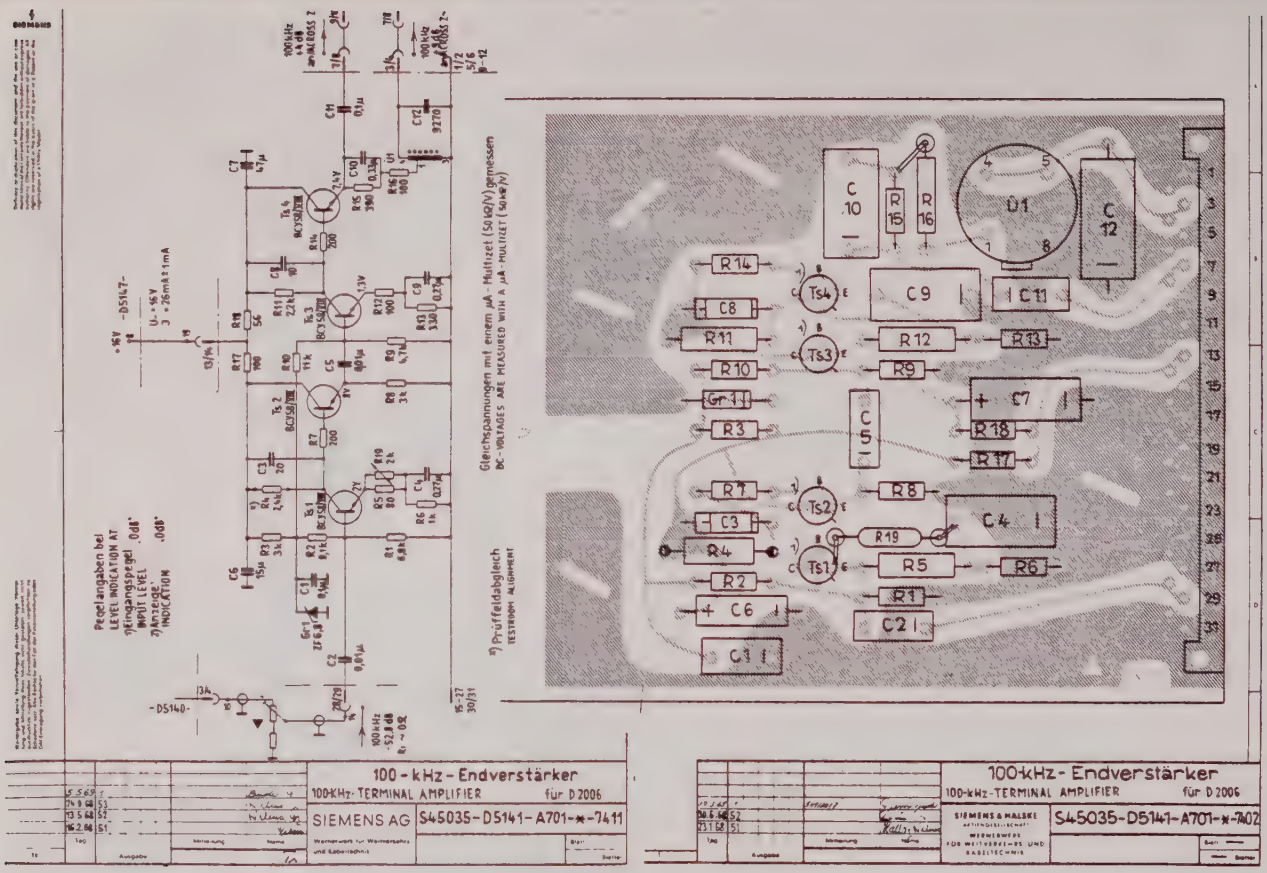

8 Vss
- 05136 -
24/29
24/29 R1 390
24...49 kHz
- 69 dB
Ri ~ 0Ω
C3 16
C6 9
L1
L3
L2
C5 180
C4 132
C8 0,01µ
R4 100
R3 13k
C8 16
R5 3k
15...27/30/31
R16 200
C15 0,1µ
R23 200
C22 0,1µ
R22 5k
C10 0,01µ
U1
Ts1 BCY 58/VIII
10 V
R6 1k
R7 1k
R8 1k
R9 1k
Gr1
Gr2 C11 3370
Gr3
Gr4
U2
Gr5 ZF 6,8
R17 39k
R11 10k
R12 2k
R18 200
C17 15µ
Ts2 BCY 58/VIII
R14 100
2,3 V
Ts3 BCY 58/VIII
8,4 V
C13 20
R13 910
C12 0,1µ
R10 8,2k
R15 2k
C14 0,22µ
12/5...12
13/14
19
5
+ 16V
- 05147 -
U = 16V
J = 20mA ± 2mA
100 kHz
- 9,5 dB
an A(RDS) 2 ~
- 05138 -
- 05139 -
Gr 1,2,3,4: hp 2900
R19 15k
R24 100
C21 220
Kr
23MHz
Gr6 ZF 8,2
C23 0,1µ
C18 18/11
C19 15
Ts4 BCY 58/VII
1,5V
R20 1k
R22 220
C20 0,01µ
R21 1,5k
Gleichspannungen mit einem µA - Multizet (50k Ω/V) gemessen
DC - VOLTAGES ARE MEASURED WITH A µA - MULTIZET (50k Ω/V)
Pegelangaben bei
LEVEL INDICATION AT
1) Eingangspegel ,0dB'
INPUT LEVEL
2) Anzeige ,0dB'
INDICATION
Modulator 3
für 2006
SIEMENS AG
S45035 - D5137 - A701 - * - 7411

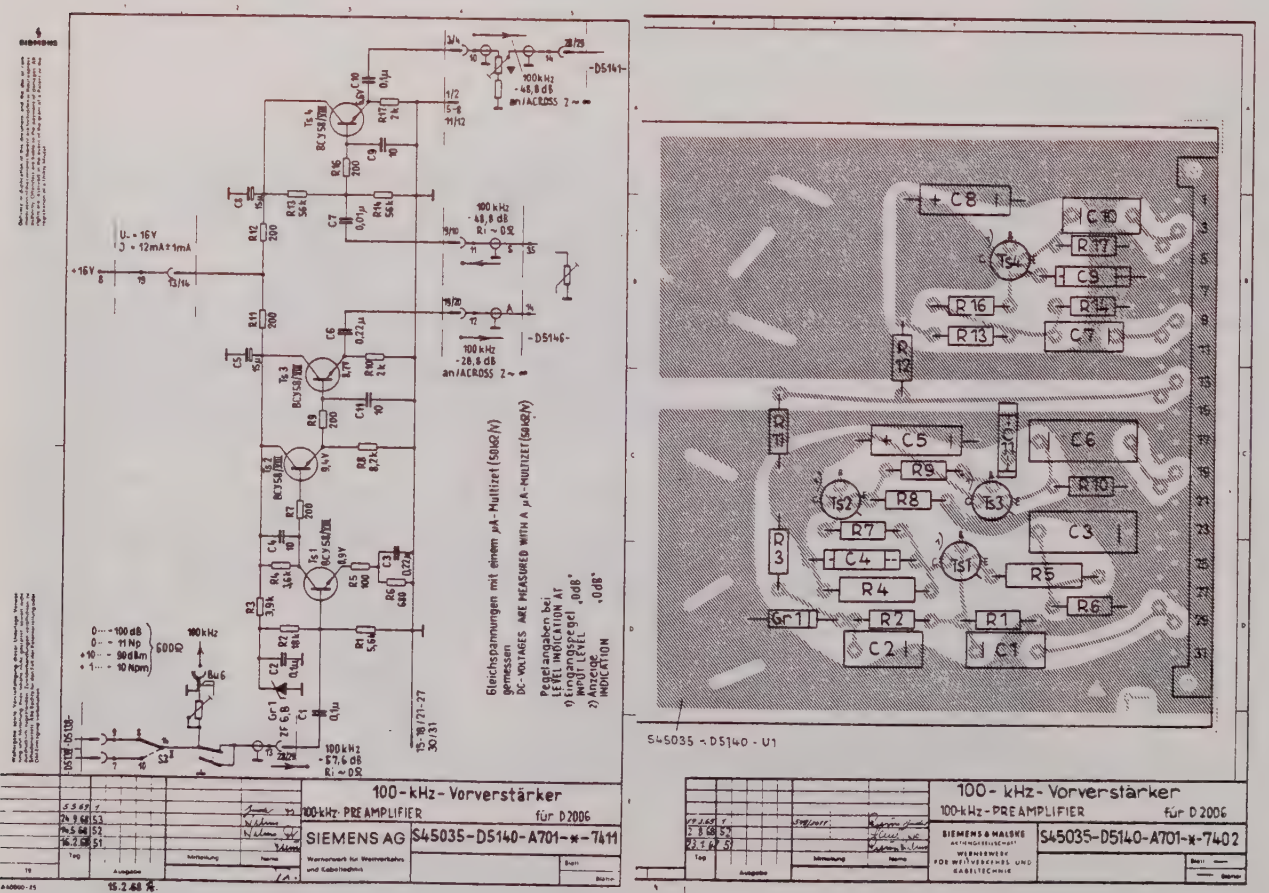

S45035 - D5137 - A701 -
C 23
C 21
U1
U2
Gr 4
Gr 3
Gr 2
Gr 1
R9
R7
R8
R6
R5
C 11
R 10
R 13
C 13
R 9
C 14
R 14
Ts2 1)
Ts3 1)
Ts1 1)
C 12
R 11
R 12
Sic 5V
R 17
C 17 +
R 18
R 22
R 24
C 22 1
C 9 2)
C 10
R 19
R 23
R 4
R 2
R 16
R 20
R 21
C 19
C 20 1
C 18
C 8
C 15
C 6
C 3
C 7
C 5
C 4
C 2
C 1
R 1
Kr
L3
L2
L1
S45035 - D5137 - U1
1) Sk-Lfd.Nr 62
2) " " " 70
3) " " " 69
4) Anschlußdrähte einfädeln und verlöten
Modulator 3
für D2006
SIEMENS & HALSKE
S45035-D5137-A701-*-7402

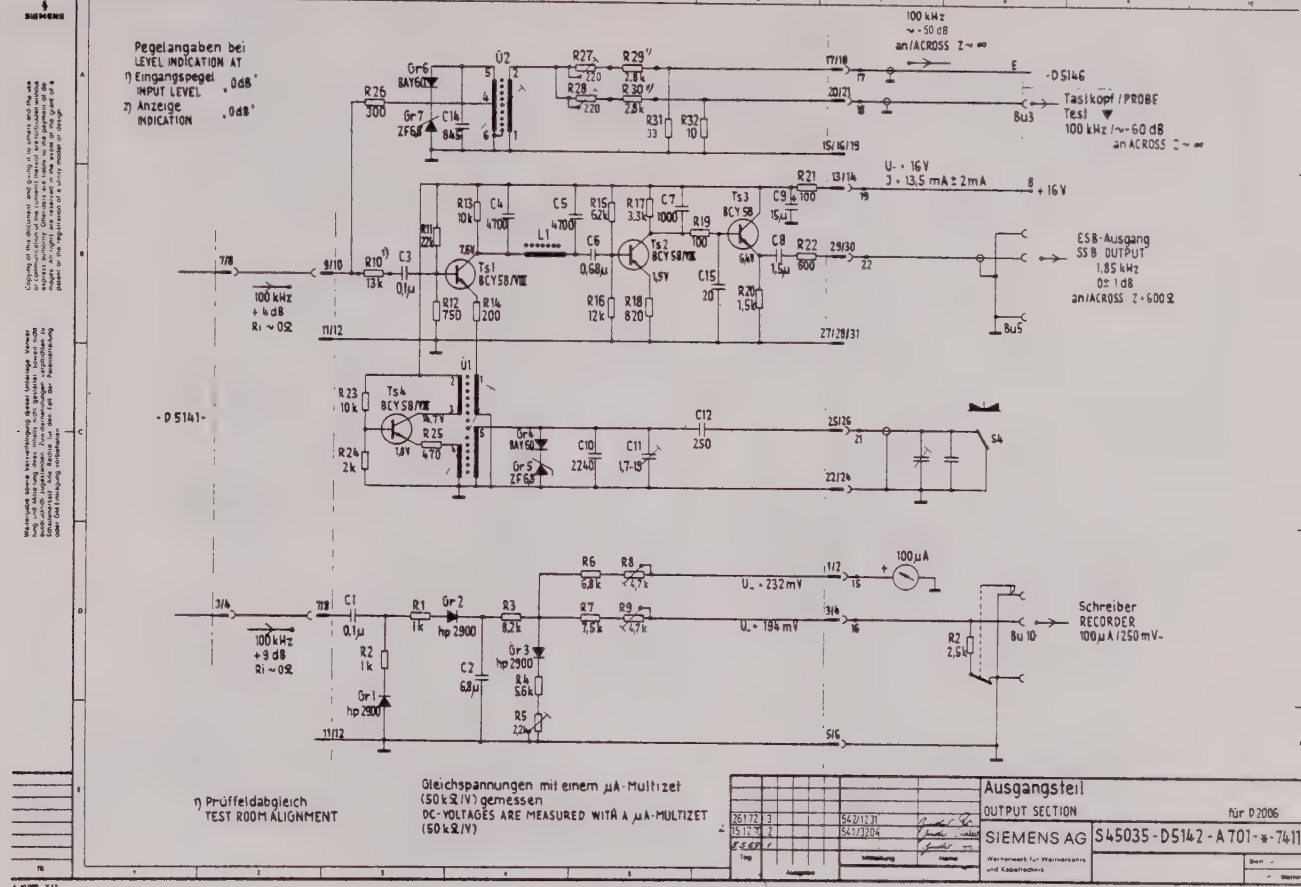

Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
Pegelangaben bei:
LEVEL INDICATION AT
Eingangspegel „0dB"
INPUT LEVEL „0dB"
Anzeige „0dB"
INDICATION
100-kHz-Quarz-Bandpaß (80 Hz)
100-KHz CRYSTAL BAND-PASS FILTER f D2006
SIEMENS AG
S45035-D5138-B701-W-7411

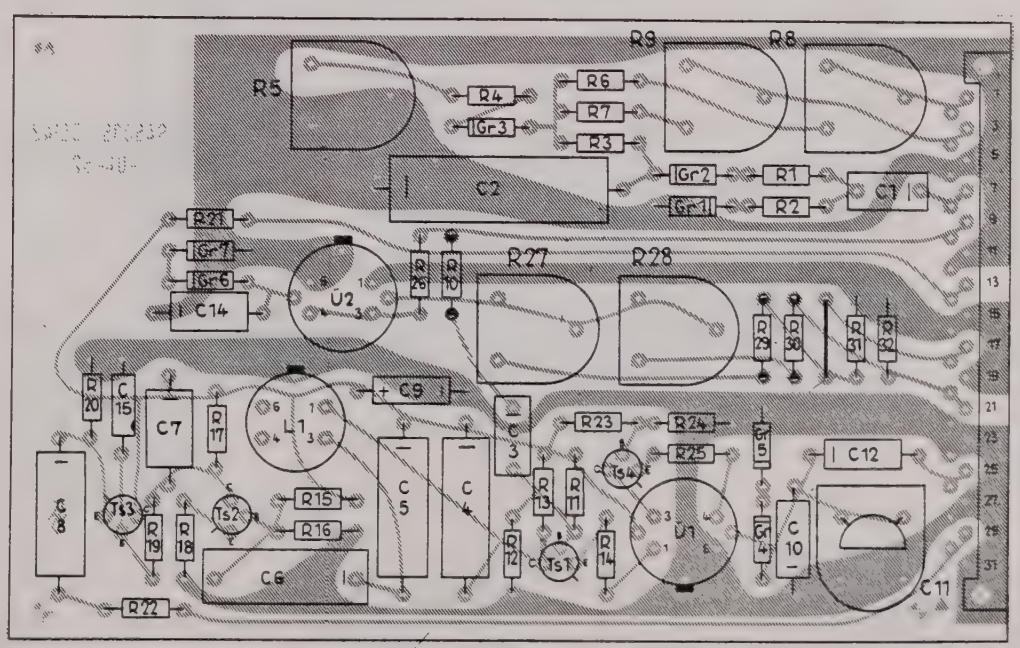

S45035 - D5138 - U2
S45035-D5138-B701
31
3) Anschlußdrähte um die Anschlußdrähte legen und verloten
100-kHz-Quarz-Bandpaß
100-KHz-QUARZ-BAND-PASS-FILTER
für D2006
SIEMENS AG
S45035 - D5138 - B701 - W - 7402

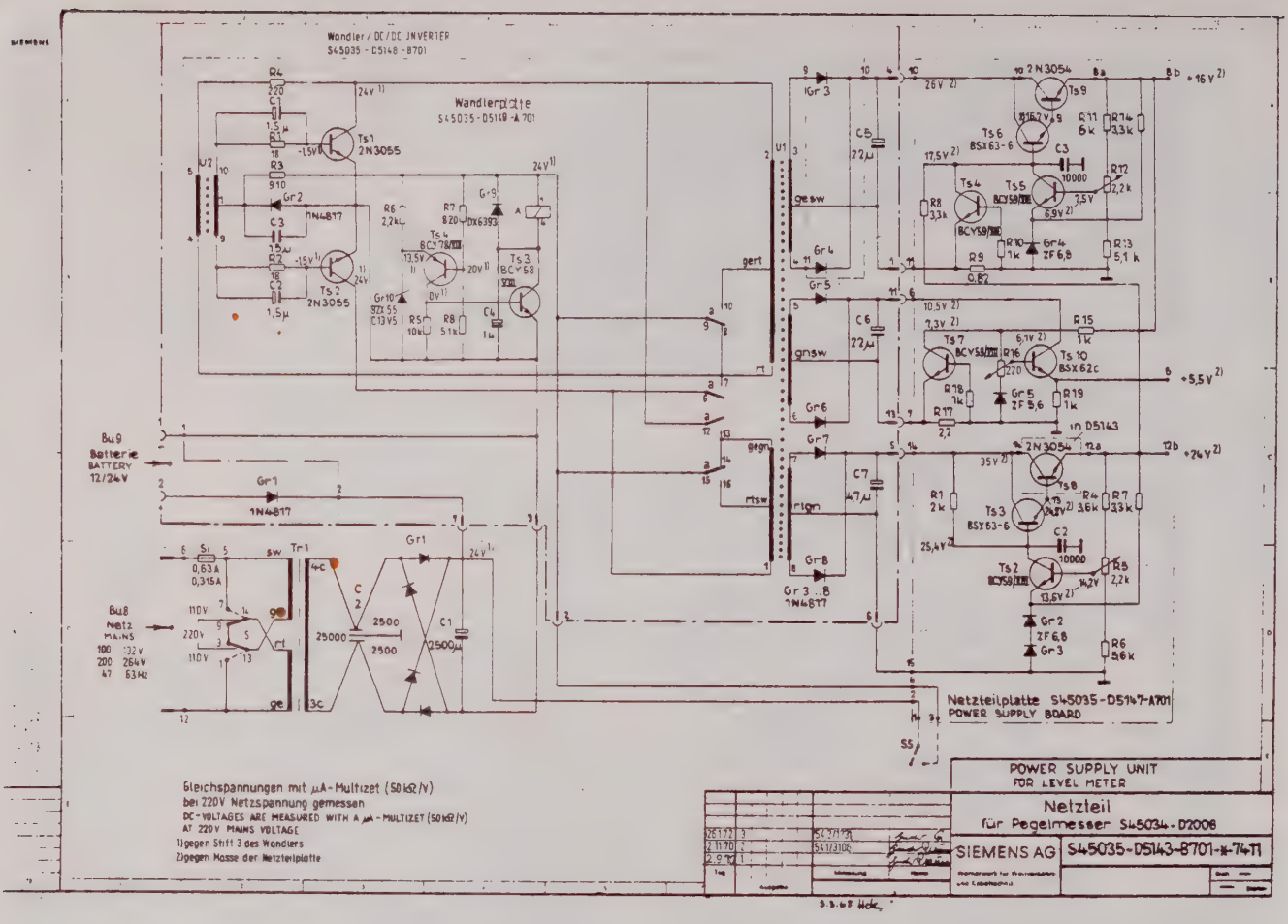
100-kHz-Spulen-Bandpaß (3,1kHz)
100-KHz COIL BAND-PASS FILTER F.D2006
SIEMENS AG
S45035-D5139-A701-x-7411
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA MULTIZET (50kΩ/V)
Pegelangaben bei:
LEVEL INDICATION AT
0 Eingangspegel „0dB"
INPUT LEVEL
Anzeige „0dB"
INDICATION
U1
U2
U3
U4
U5
U6
T1
T2
S1
S2
S3
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
S45035-D5139-A701-
S45035-D5139-U1
100-kHz-Spulen-BP (3,1kHz)
100-kHz-BAND-PASS-FILTER für D 2006
SIEMENS & HALSKE
S45035-D5139-A701-x-7402

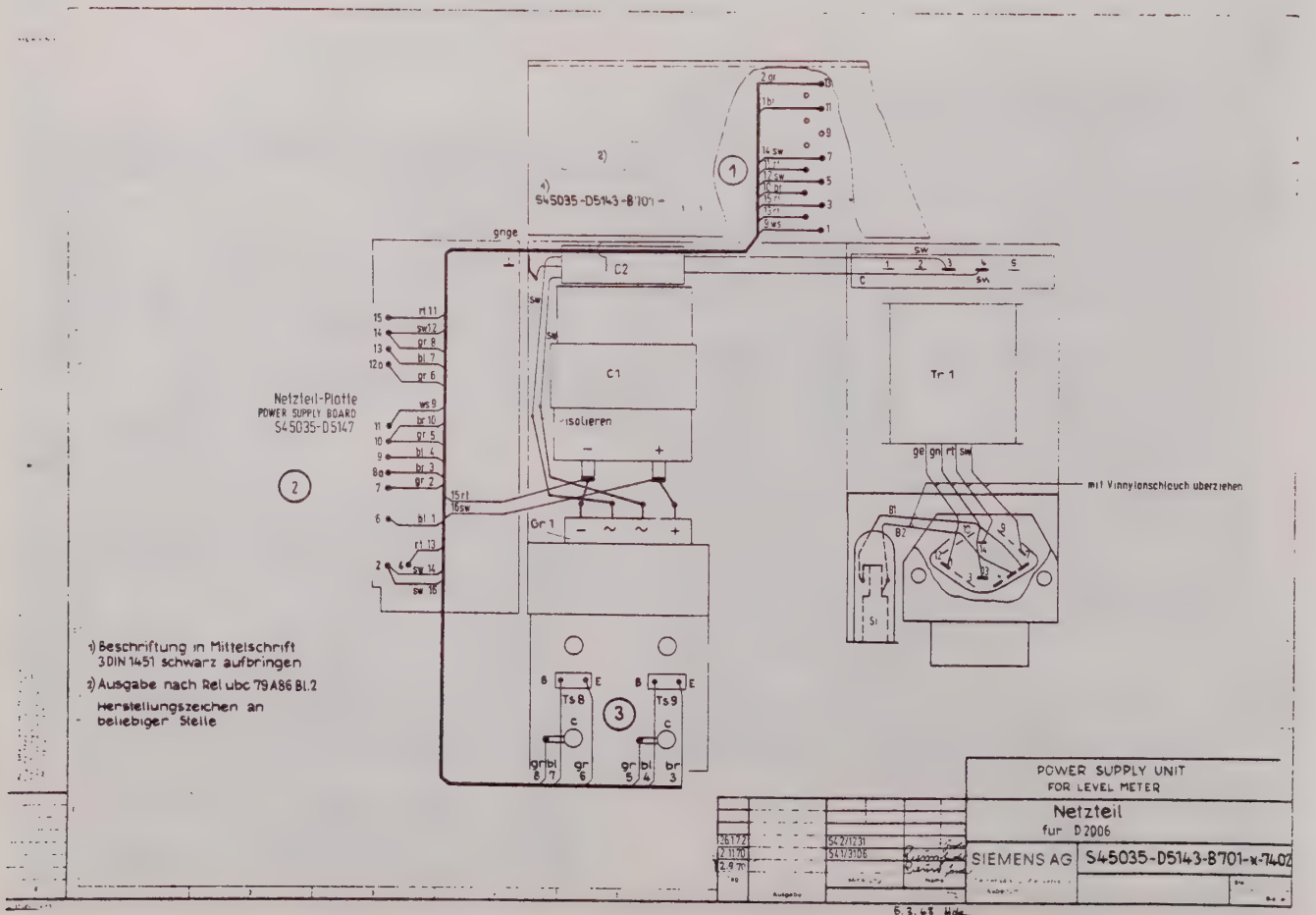

100-kHz-Endverstärker
100-kHz-TERMINAL AMPLIFIER
für D 2006
SIEMENS AG
S45035-D5141-A701-*-7411
S45035-D5141-A701-*-7402
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
Pegelangaben bei
LEVEL INDICATION AT
1)Eingangspegel 0dB
INPUT LEVEL
2)Anzeige 0dB
INDICATION
1) Prüffeldabgleich
TESTBENCH ALIGNMENT
-D5141-
-D5140-


100-kHz-Vorverstärker
100-kHz-PREAMPLIFIER
für D 2006
SIEMENS AG
S45035-D5140-A701-*-7411
S45035-D5140-A701-*-7402
Gleichspannungen mit einem µA-Multizet (50kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
Pegelangaben bei
LEVEL INDICATION AT
1) Eingangspegel 0dB
INPUT LEVEL
2) Anzeige 0dB
INDICATION
S45035-D5140-U1
-D5146-
-D5141-

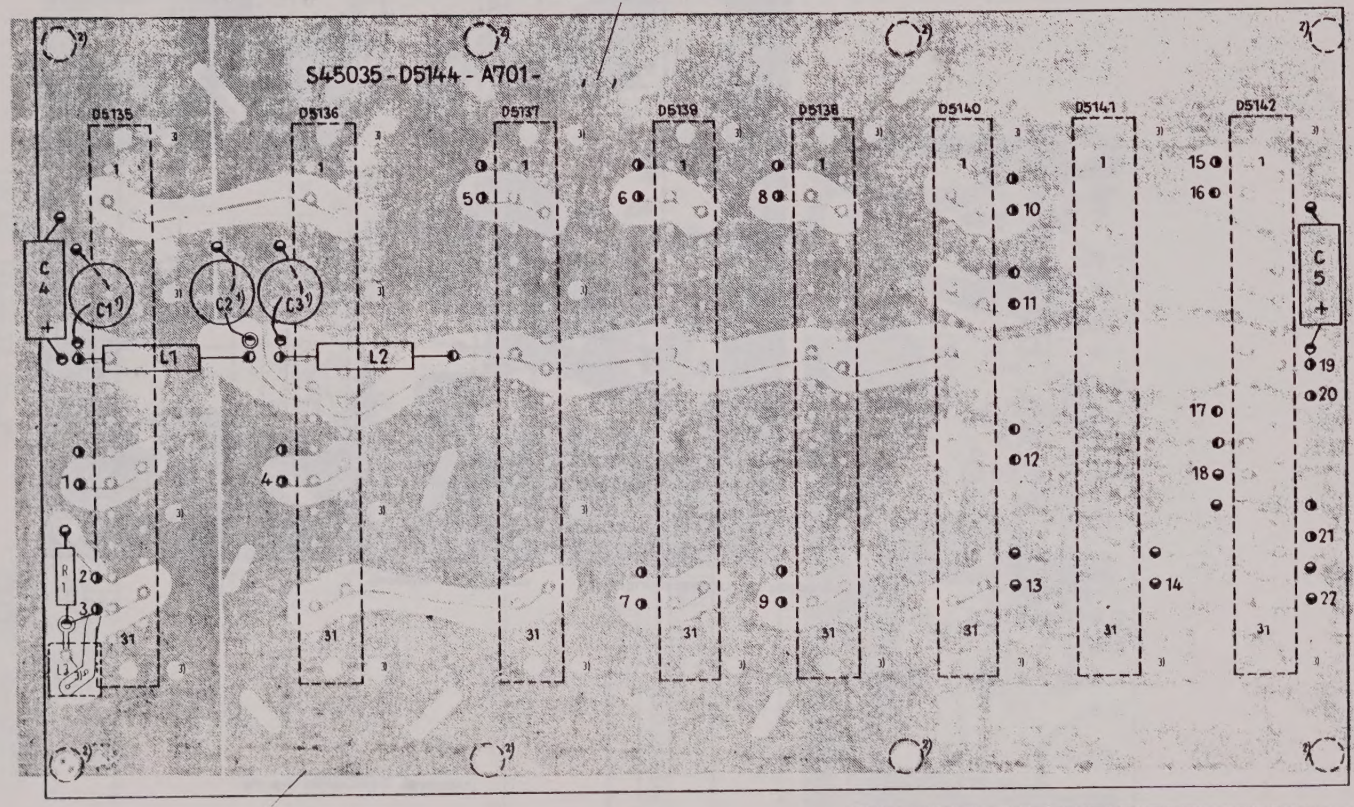

Pegelangaben bei
LEVEL INDICATION AT
1) Eingangspegel / INPUT LEVEL „0dB"
2) Anzeige / INDICATION „0dB"
100 kHz ~ -50 dB an/ACROSS Z ~ ∞
-D5146
Tastkopf / PROBE Test 100 kHz / ~ -60 dB an ACROSS Z ~ ∞
U- = 16 V J = 13,5 mA ± 2 mA
+ 16 V
ESB-Ausgang SSB OUTPUT 1,85 kHz 0± 1 dB an/ACROSS Z = 600 Ω
100 kHz + 6 dB Ri ~ 0 Ω
-D5141-
100 kHz + 9 dB Ri ~ 0 Ω
U- = 232 mV
U- = 194 mV
100 µA
Schreiber RECORDER 100 µA / 250 mV-
1) Prüffeldabgleich
TEST ROOM ALIGNMENT
Gleichspannungen mit einem µA-Multizet (50 kΩ/V) gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50 kΩ/V)
Ausgangsteil
OUTPUT SECTION
für D 2006
SIEMENS AG
S45035-D5142-A701-*-7411


S45035-D5142-U1
Lotstift
Sk-Lfd.Nr. 75
Einbaulage beachten
Ausgangsteil
OUTPUT SECTION
für D 2006
S45035-D5142-A701-x-7402


Wandler / DC/DC INVERTER
S45035 - D5148 - B701
Wandlerplatte
S45035-D5149-A701
Netzteilplatte S45035-D5147-A701
POWER SUPPLY BOARD
Gleichspannungen mit µA-Multizet (50 kΩ/V)
bei 220V Netzspannung gemessen
DC-VOLTAGES ARE MEASURED WITH A µA-MULTIZET (50kΩ/V)
AT 220V MAINS VOLTAGE
1) gegen Stift 3 des Wandlers
2) gegen Masse der Netzteilplatte
POWER SUPPLY UNIT
FOR LEVEL METER
Netzteil
für Pegelmesser S45034-D2006
SIEMENS AG
S45035-D5143-B701-x-7411


Netzteil-Platte
POWER SUPPLY BOARD
S45035-D5147
mit Vinnylonschlauch überziehen
1) Beschriftung in Mittelschrift
3 DIN 1451 schwarz aufbringen
2) Ausgabe nach Rel ubc 79 A86 Bl. 2
Herstellungszeichen an
beliebiger Stelle
POWER SUPPLY UNIT
FOR LEVEL METER
Netzteil
für D2006
SIEMENS AG
S45035-D5143-B701-x-7402

Auf die Leiterseite gesehen!



S45035-D5144-U1

Lötstift
Sk-Lfd.Nr. 8
Einbaulage beachten

1) C1,2,3 liegend einlöten

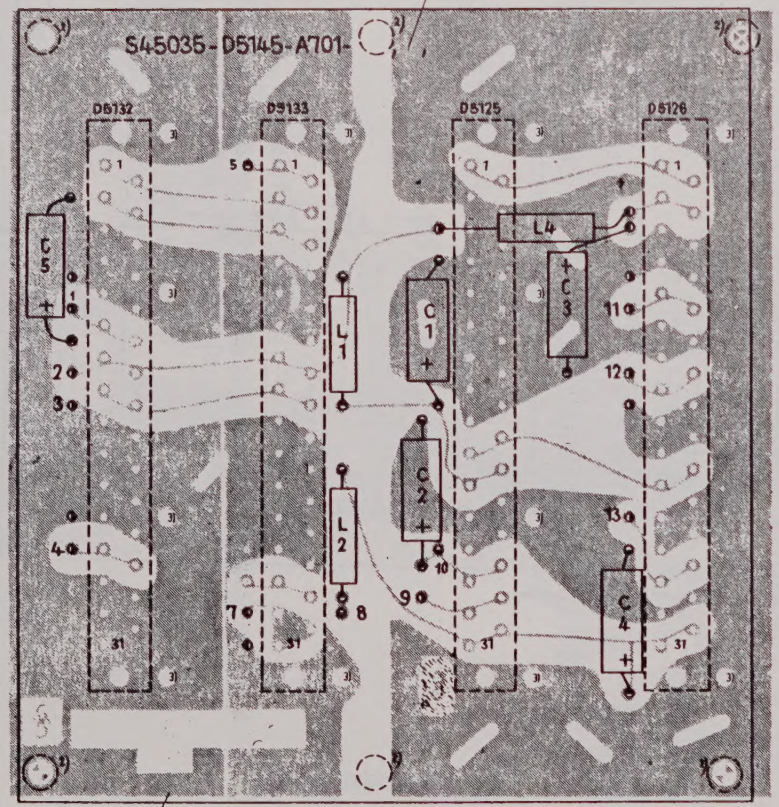
2) 7mm ⌀ frei von Lötzinn

3) Bohrung frei von Lötzinn

26.1.72						Grundplatte 1	
23.9.71	3					BASE PLATE 1	für D 2006
8.12.69	2					SIEMENS & HALSKE	S45035-D5144-A701-x-7402
30.6.52	1						
5.3.62	57						

Auf die Leiterseite gesehen!

Ausgabe von Sk,str,ms Herstellungszeichen an beliebiger Stelle

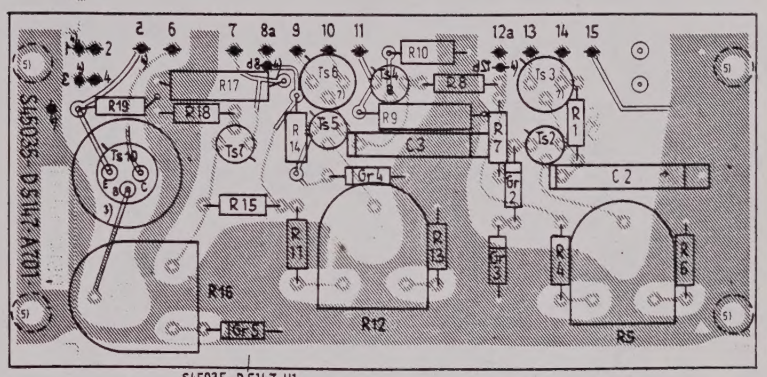


S45035-D5145-U1

Lötstift
Sk-Lfd.Nr.8
Einbaulage beachten

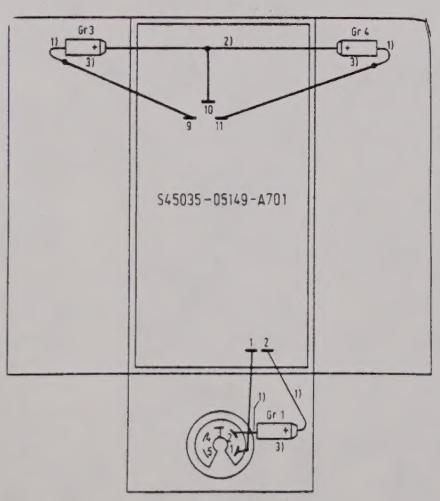
2) 7mm ⌀ frei von Lötzinn
3) Bohrung frei von Lötzinn

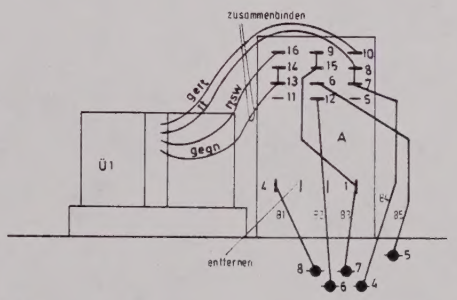
26.1.72	3				Grundplatte 2	
2.12.71	2			BASE PLATE 2		für D 2006
22.4.69	1					
21.1.69	S3			SIEMENS & HALSKE	S45035-D5145-A702-K-7402	
30.6.68	S2					
5.3.68	S1					
Tag	Ausgabe					

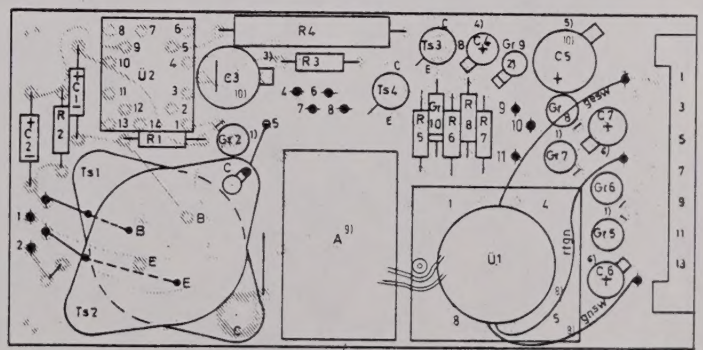


S45035-D5147-U1

26.1.72	5					Netzteilplatte	
17.1.69	4	S42/1231				POWER SUPPLY BOARD	für D2006
4.5.67	2	5441/1017					
11.3.64	1					SIEMENS & HALSKE AKTIENGESELLSCHAFT WERNERWERK FÜR WEITVERKEHRS UND KABELTECHNIK	S45035-D5147-A701-*-7402
Tag	Ausgabe	Mitteilung	Name	Änderung Nr.			Blatt



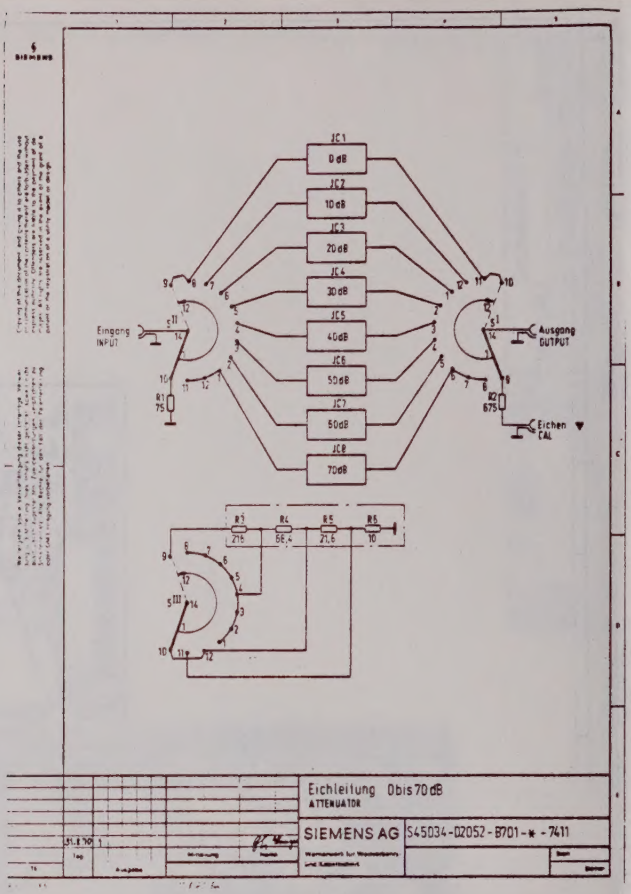




S45035-D5149-U1

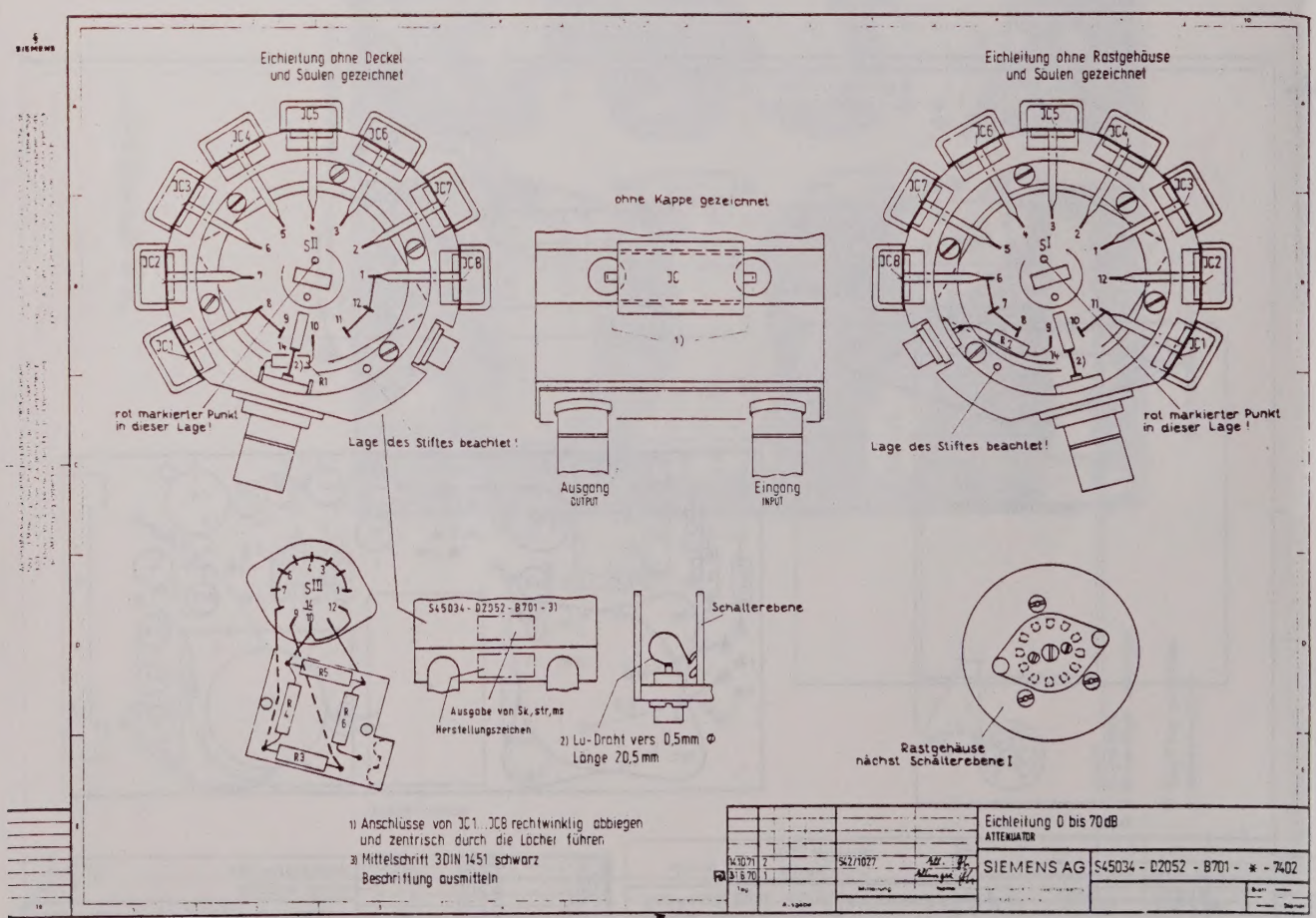
						Wandler 12/24	
						DC/DC INVERTER	für D2006
26.1.72	2	S42/1231				SIEMENS AG	S45035-D5148-B701-*-7402
24.9.70	1					Werkvertrag für Wernerwerke und Kabeltechnik	
Tag	Ausgabe	Mitteilung	Name				Blatt — Blätter —

26.1.72	6	S42/1231				Wandlerplatte	
24.9.70	5	S40/1018				DC/DC INVERTER	für D 2006 W 2006
5.70	4	S40/1645				SIEMENS & HALSKE AKTIENGESELLSCHAFT WERNERWERK FÜR WEITVERKEHRS UND KABELTECHNIK	S45035-D5149-A701-x-7402
4.70	3	S40/2722					
2.10.69	2	S40/1163					
11.3.69	1		ges. Bruder				Blatt — Blätter —
Tag	Ausgabe	Mitteilung	Name				



Eichleitung 0bis70dB
ATTENUATOR

SIEMENS AG | S45034-D2052-B701-*-7411



1) Anschlüsse von DC1...DC8 rechtwinklig abbiegen
und zentrisch durch die Löcher führen

3) Mittelschrift 3DIN 1451 schwarz
Beschriftung ausmitteln

Eichleitung 0 bis 70dB
ATTENUATOR

SIEMENS AG | S45034-D2052-B701-*-7402